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Page 129, para (4), the first sentence should read as follows :—' In the same District (Sadiya) during 1936-37 in August I shot a Pintail on the 13th, I saw a Snipe on the 19th August but failed to secure it. I bagged a Pintail on......etc.'

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Page 325, line 6 from top, for ' Forty Years among the Wild Beasts of India ' *read* ' Thirteen Years among the Wild Beasts of India.'

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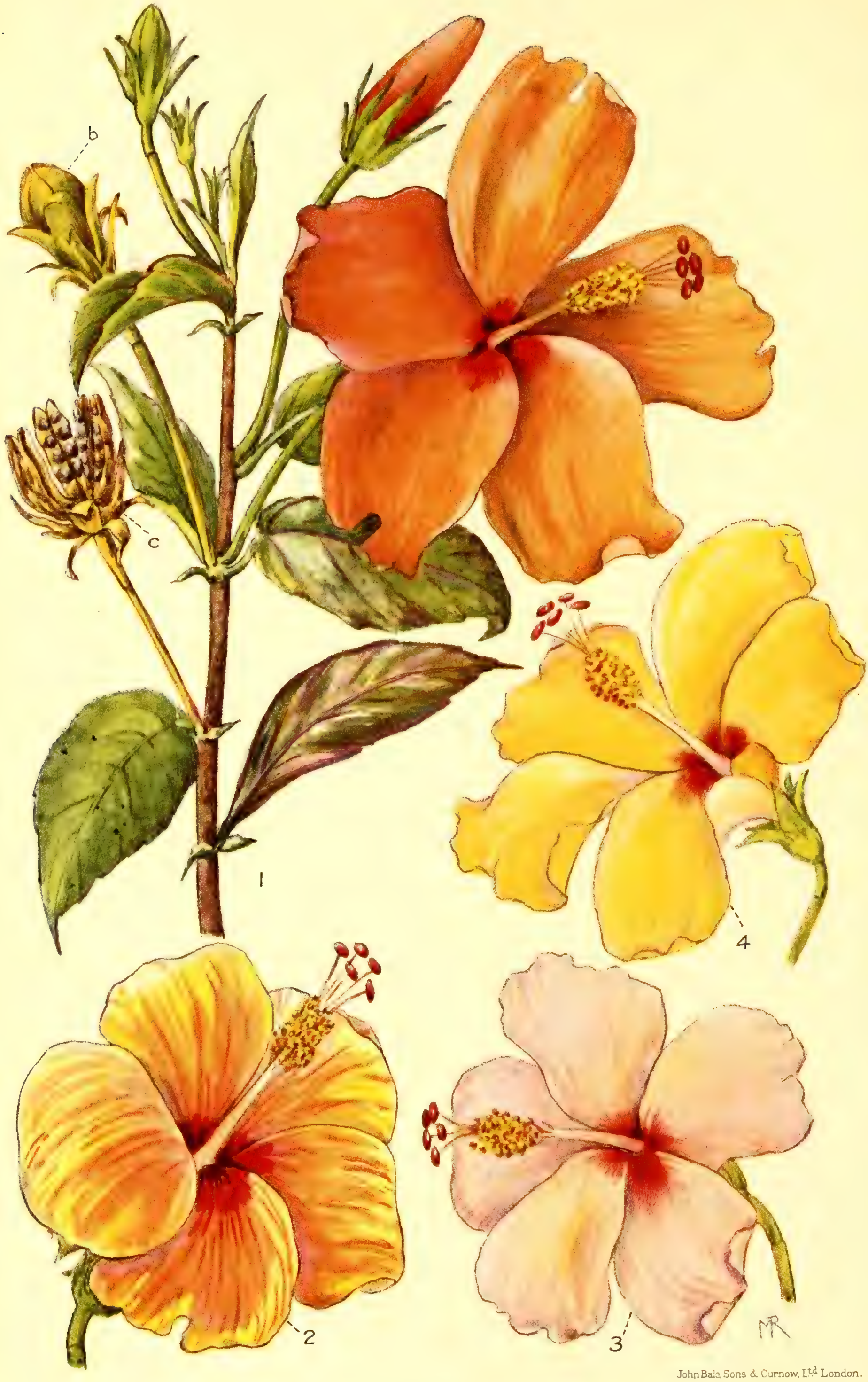

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Varieties of Hibiscus
(For explanation see end of article).

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SOME NOTES ON THE RAISING OF HIBISCUS SHRUBS FROM SEED.

BY

M. E. ROBINSON, M.A. (CANTAB).

(*With* 1 *coloured plate and* 1 *black and white plate*).

Among the many beautiful flowering shrubs cultivated in South Indian gardens, the Hibiscus is a popular favourite. There are several species and varieties commonly met with; and their large and handsome flowers appear at all times of the year, and brighten our gardens with the vivid gaiety of their colouring, when the more ephemeral beauty of annuals is over. Some shrubs produce single trumpet-shaped flowers of great size and beauty; others have a double flower resembling a large full-blown rose, but without its scent.

The Hibiscus belongs to the *Malvaceae* Order of plants, and in common with the other members of the Order, the flower has five large separate petals, enclosed in a calyx of five large green sepals, outside which is a second calyx of five or more narrow leaves or bracts. The filaments of the stamens are all joined to form a long tube, bearing a bunch of yellow anthers at the top, and through the centre of the staminal tube passes the long style ending in five round velvety stigmas, ranging in colour from deep orange to crimson, spread out among the yellow stamens. This centre tube is often three to four inches long, and sometimes stands stiffly in the centre of the flower, and sometimes hangs limply from the inverted blossom. The flower is sometimes trumpet-shaped; sometimes the petals open almost flat to a salver shape; and sometimes the petals are recurved.

The shrubby species most commonly planted in gardens are as follows:—

Hibiscus Rosa-sinensis Linn.: This is the Common Scarlet Hibiscus, not indigenous, but introduced from China. Trumpet-shaped flowers, but varieties with recurved petals are also found and double varieties are common.

MAY [illegible]

H. schizopetalus Hook. fil.: Scarlet or scarlet streaked with white petals, very much cut up into narrow segments quite reflexed, with a long pendulous tassel of stamens and stigma. It reminds one of a Japanese lantern, and is sometimes called the '*Japanese lantern flower*'.

H. splendens Fras. and *H. collinus* Roxb.: Both have large trumpet-shaped single flowers of a pale rose-pink. Double pink varieties are often seen.

H. tiliaceus Linn.: is a small tree indigenous in the Konkan and with straw-yellow flowers.

H. elatus Sw.: has sulphur yellow flowers.

H. syriacus Linn.: has large blue-mauve trumpets with pure white staminal column and stigmas. There is also a variety of this with pure white petals.

H. mutabilis Linn.: This species known as the *Persian Rose* has in the morning huge, pure white, double blooms, which change colour during the day. At noon it is a pale pink; by five o'clock in the afternoon, a deep rose, almost red. There is also a single variety.

All these species can be readily propagated by cuttings and as they rarely, if ever, produce seed, that is the usual method of increasing one's stock. Very rare cases of seed production have been observed as for instance the case mentioned by Woodrow in his book *Gardening in the Tropics,* published in 1910, where he refers to, and gives an engraving of some plants of *H. Rosa-sinensis* in Poona that produced seed in 1879, nothing apparently occurring in the intervening period of 31 years. Some recent researches into the structure of the reproductive organs of *H. Rosa-sinensis* undertaken by Prof. Tiwary and his students at the Benares Hindu University seem to show that there is some defect in the cells from the pollen grain that precludes the formation of seed.

There are however some species not included in the above list that do produce seeds quite freely. Of these there are three species, or what appear to be different species, in my possession and from them seeds have been collected and seedlings grown which show very interesting variations in colour and shape of flower, and leaves. These three plants which I shall call species 1, 2 and 3 (as I do not know and am not able to find out the specific names), were obtained as cuttings from plants grown by Mr. G. E. Browning in his garden at Trichur, Cochin State. He had a large collection of Hibiscus plants with flowers of every variety of colour; red, pink, yellow, orange and peach, in every imaginable shade, as well as the blue *H. syriacus.* Many of his plants came originally from Singapore, and also from Calcutta and I have since been told that the peach coloured Hibiscus Species 1 is very commonly grown in Malaya.

Species 1. **Peach** (Coloured plate, fig. 1).

This has very large flowers of a deep peach or apricot colour. The colour is very rich, and uniformly distributed, showing no differentiation into its component pink and yellow. During the day, however, the pink or red component fades out, leaving the bloom a pale straw colour by the evening. This loss of red colouring matter occurs in all the species except the scarlet ones, and is an interesting variation from the behaviour of *H. mutabilis* which, as mentioned above, *develops* a red colouring matter, changing from white to deep pink. At the base of each petal is a deep crimson splash; the staminal column is peach coloured, the stamens sulphur yellow, and the five scarlet velvet stigmas, borne on pale peach coloured styles, protrude beyond the stamens. The seeds are produced in capsules which split open into five, exposing the grey velvety seeds (Plate, figs. 1b and c). The leaves are simple ovate, with a rather long point (text-fig. 1) and irregularly serrate in the upper half; the lower half tapers somewhat to the stalk. The surface is smooth and glossy, and they are often of a bronze shade, with red veins, clearly seen on the back of the leaf. In quite young seedlings grown from seeds of this plant this bronze colour is quite pronounced, sometimes even appearing in the cotyledons as soon as the first leaves expand.

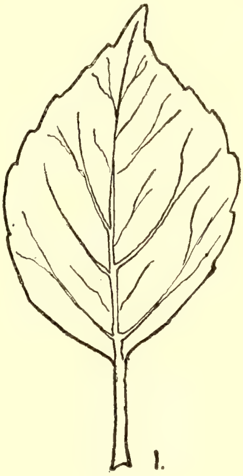


Fig. 1.

Species 2: **Sunrise** (Col. Plate, fig. 2).

This species has very large, very regular flowers, the petals being more rounded at the outer half, and overlapping almost to the edge; so that the shape is a more regular trumpet or spreading horn. In colour it is a clear sulphur yellow, irregularly flushed with pink, and streaked with pink veins. The base of the petals are of a very rich crimson, and the staminal column is red at the base shading to the sulphur yellow of the stamens. The orange coloured stigmas are on yellow styles. This is a very beautiful flower reminding one of a sunset or sunrise sky, and as they open in the early morning, and close at night as do all *Hibiscus*.

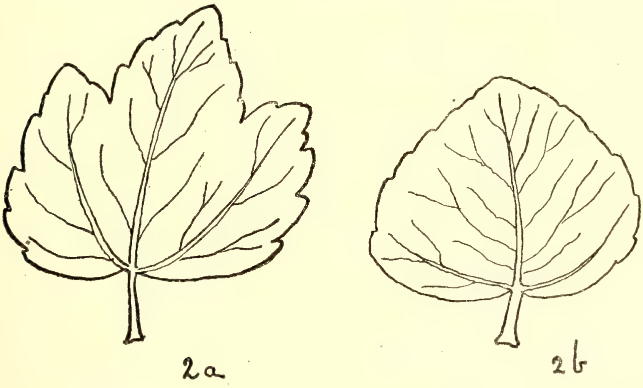


Fig. 2.

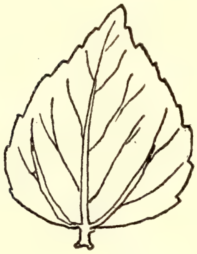
'Sunrise' seems a most appropriate name. The red fades out of this flower, leaving it a pale clear sulphur yellow at evening.

The capsules and seeds are exactly similar to those of species 1, but very rarely produced. Three seedlings were produced from it in 1934 one only having survived, variety 13. The leaves of this species are simple cordate or cut into three lobes with large uneven serrations at the edges. Many variations of shape occur, fig. 2 (a) and (b) being leaves from the same plant.

For some years the original cutting of this species suffered from a disease which caused the flowers to fall off before they opened, and the leaves to be veined and blotched with pale yellow. It recovered somewhat but has lately suffered again from it. Cuttings taken from it however have grown into strong healthy plants with perfect flowers of a very large size, and leaves with no trace of yellow.

Species 3: **Cherry.**

This species has large flowers of a beautiful shade of cherry or coral red. The lower half of the petal shades to mauve, on which is superimposed the usual crimson patch at the base, so that the colouring of this flower is very subtle, and quite different from the crude scarlet of *H. Rosa-sinensis*. The staminal tube is red, deeper at the base, stamens sulphur yellow, and the scarlet stigmas on pale red styles.



3.

Fig. 3.

Capsules and seeds the same as 1 and 2—less numerous than 1, more numerous than —and several seedlings were produced in 1934.

The leaves (fig. 3) are somewhat intermediate between those of species 1 and 2, being broader and shorter than 1 but not so broad as 2, and show no lobed varieties. The edge is irregularly rather deeply serrated.

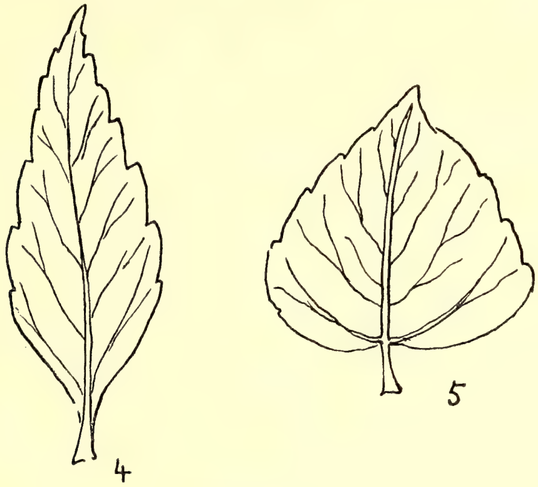
Two leaves are shown in figs. 4 and 5 for comparison, taken from two varieties of *H. Rosa-sinensis*, also growing in the compound.

All these plants do well in a good soil and with plenty of rain, but where the soil is poor and rainfall scanty, as at Negapatam, it is better to have them in large tubs. Cuttings root freely and the stock of plants can easily be increased in this way.

It was soon observed however that species 1 produced seeds very freely and some of these were collected and sown and seedling plants were obtained from them in about 1927. There are four quite different varieties of flowers among these seedling plants, which are now as large as the parent bushes, and themselves bear seed.

In October to December 1933 a large number of seed capsules were produced on all the bushes.

The flowers are visited at all hours of the day by small birds, chiefly the 'sun birds' (*Cinnyris asiaticus* and *zeylanicus*) and the 'tailor bird' (*Orthotomus sutorius*), of which there are any number in the compound. I have never seen them at the front of the flowers however; they seem always to insert their beaks between the petals from the back of the flower, or to peck holes in the petals, to reach honey or insects at the bottom of the trumpet.



Figs. 4 and 5.

Numbers of large butterflies, particularly a black and scarlet species and a white one with black veins and black, orange and blue patches visit these flowers also, and I should imagine that fertilisation takes place through their agency, rather than as a result of the visits of the birds.

At the beginning of 1934 seed production seemed to fall off, and so artificial pollination was tried. Pollen from the stamens of a flower from species 1 being applied to the stigma of species 2 or 3 by lightly brushing the stamens against it. Similarly pollen from species 2 was applied to species 1 or 3 and so on.

The result was a very marked increase in the number of seed capsules formed and the capsules were larger and healthier, and produced more seeds than ever before. This was particularly the case with species 2 and 3 which had hitherto only rarely produced seed.

This would seem to indicate that the lack of seed may be due sometimes to failure of pollination by outside agencies and not to any defect in the structure as in the case of *H. Rosa-sinensis;* but this is a subject that requires further investigation before any definite conclusion can be reached. The seeds obtained in 1933-34 germinated well, and at the end of 1934 there were about seventy healthy seedlings. These were put into six inch pots, and those that survived the hot weather, March to July, of 1935 started to flower in October 1935. A great many of these were given away, as I was not able to deal with so large a number but I have seen some of these young plants at various times, and some of the flowers they have produced. Among those remaining with me there are certainly seven that have flowers quite different from any of the original three species or first four varieties. Several reproduce the original peach of species 1 exactly, one reproduces species 3. There are two very different reds, and several of different shades of peach, some paler, some more pink, some more yellow, and so on. It is difficult to describe colours but an attempt is made in the following list to show the variety of the flowers produced by the seedling plants now in the garden.

Variety 1: Practically identical with original Peach Species 1. Occurs frequently.

Variety 2: Pale salmony pink, very delicate shade; seeds freely, and seedlings have been raised from it. (Col. Pl., fig. 3.)

Variety 3: Clear straw yellow, no pink, dark maroon centre; produced one seed capsule, but died in 1935 (Col. Pl., fig. 4).

Variety 4: Clear cherry red, no mauve; narrow petals, trumpet-shaped flowers.

These four varieties flowered before 1934. The following varieties flowered for the first time between October 1935 and March 1936.

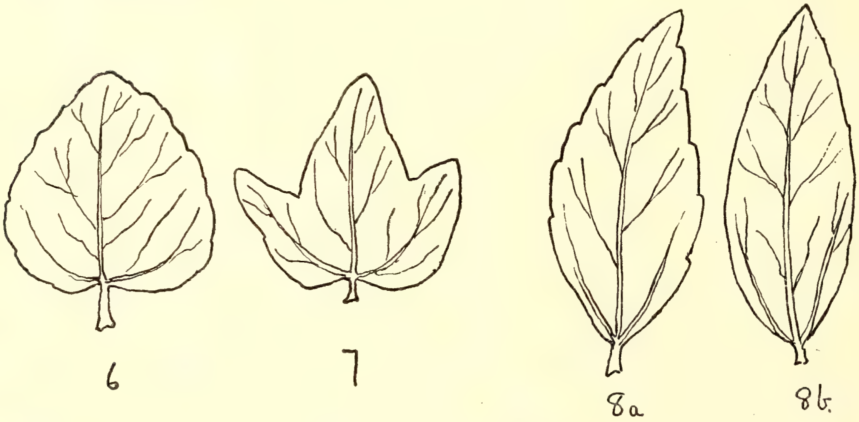
Variety 5: Very dark orange or peach colour; short trumpet, flat flower.

Variety 6: Salmony pink or peach with a pink flush.

Variety 7: Darker salmony pink or peach with a pink flush. (Occurred also in Madras.)

Variety 8: Peach, resembling variety 1, but with a patch of clear yellow on each petal.

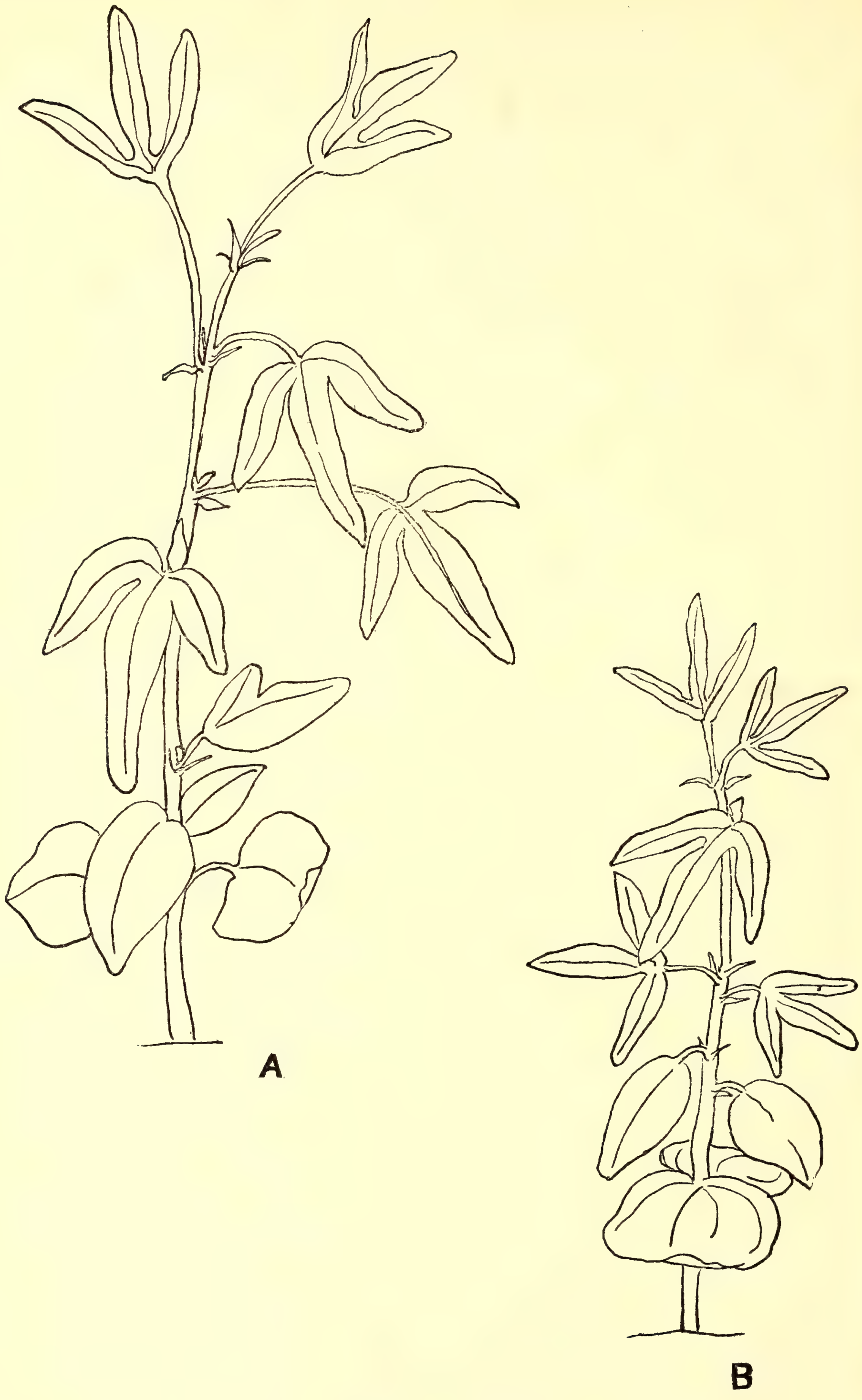
Variety 9: Peach with a mauve flush on lower half of petal and purple centre. Occurred in Madras and Podanur.



Figs. 6, 7, 8a and 8b.

Variety 10: Salmony pink, but with a mauve flush, lower half of petals mauve purple centre. This flower is very different in the evening, as all the pink fades out leaving it clear pale yellow with mauve to purple centre.

Variety 11: Very large, rich scarlet flowers with a yellow streak down the overlapping edge of each petal. Very dark red centre.



Seedlings of Hibiscus
showing variation in leaves.

Variety 12: Bright tomato red; much smaller and unusual in having the centre almost the same colour as the rest of the petal no dark patch at the base.

Variety 13: Exactly like *Sunrise*, species 2. Leaves mostly as fig. 1 or 8, a few 2a or 7.

The leaves of these young plants show all kinds of variation in size and shape (Figs. 6, 7, 8a and 8b). In the seedlings some have the leaves all of the type of figs. 1, 3 or 4. Others have the lobed leaf of fig. 7. Occasionally both types are found on the same seedling (Plate II, figs. A and B), and on older plants a bunch of the palmate leaves will appear on a small branch of a plant with ovate lanceolate leaves.

The red colouring matter is often found in the first leaves giving them a bronze appearance.

This very slight and incomplete study of hybridisation in these species of Hibiscus seems to give very interesting results, and to indicate that it might very easily be carried further to establish the true Mendelian behaviour of the species, and incidentally to produce some new varieties of this very beautiful plant for our gardens.

Explanation of Coloured Plate.

Fig. 1.—Peach Hibiscus; b. capsule; c. capsule with seed exposed.
Fig. 2.—Sunrise Hibiscus.
Fig. 3.—Pale salmony-pink variety.
Fig. 4.—Clear straw-yellow variety.

MALAYAN GAUR OR SELADANG.

(*Bibos gaurus hubbacki*)

BY

THEODORE HUBBACK.

(*With 5 black and white plates*).

The variety of Gaur found in the Malay Peninsula was designated as a subspecies by Lydekker in 1907, who gave the following reasons for doing so in his book *The Game Animals of India, Burma, Malaya, and Tibet*:—

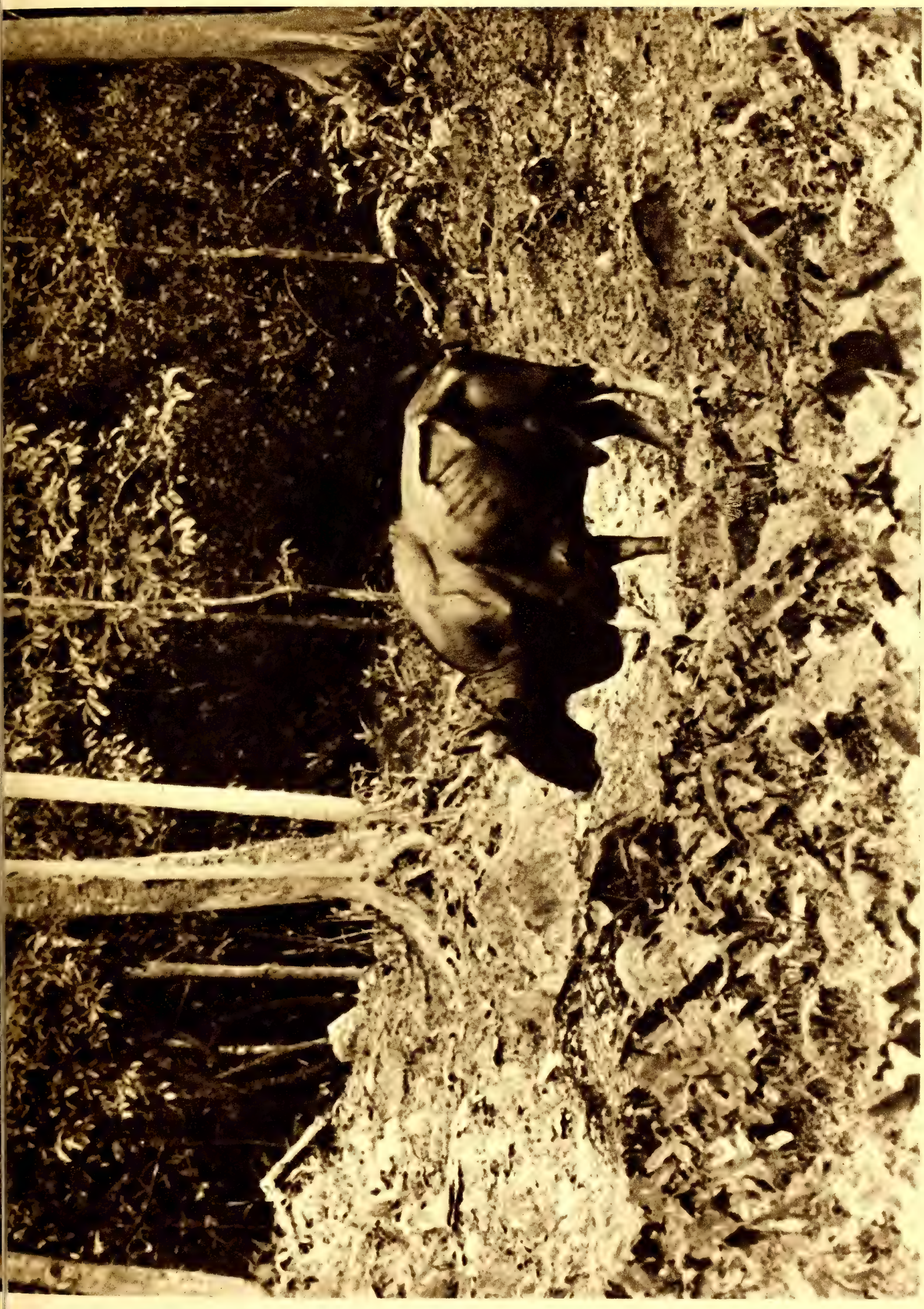
'If the pyoung, or Burmese gaur, is separated from the Indian animal, there can be no reasonable doubt that the seladang, or Malay representative of the species, is likewise entitled to similar rank. This probability is converted to a certainty by the distinctive features presented by three adult bull seladang heads recently sent to London by Mr. T. R. Hubback, author of *Elephant and Seladang Hunting in Malaya*, London, 1904. In that work Mr. Hubback himself states that in adult seladang there is no dewlap, and the colour of the "stockings" is dirty yellow. The heads just referred to show that the seladang has a much smaller development of the ridge between the horns than the Indian gaur, a greater extent of tawny on the forehead, and also a distinct whitish band above the muzzle. In one of the heads there is a fair development of the intercornual ridge, but in the other two the line between the horns is quite straight; in fact, if it were not for the horns, which are of the characteristic gaur type, these two heads might almost be referred to as gayal. They render it practically certain that the latter is not specifically distinct from the gaur; and it is significant in this connection that the one supposed specimen of a wild gayal was killed in Tenasserim.

'The seladang may be named *Bos gaurus hubbacki*; a specimen presented by Mr. Hubback to the British Museum being taken as the type.'

This description, as I shall show later, is not quite accurate, regarding the absence of a dewlap, in fact if such a phenomenon is to be taken as a ground for the making of subspecies it is possible that there may be two subspecies of gaur in Malaya.

Calf seladang are of a bright golden bay colour but it is possible that this colour does not develop in its full brilliancy until the calf is a few weeks old. Regarding this point I am not very certain although I have seen very small calves which were mouse-colour instead of the golden bay colour that I would have expected to see.

When the calves are about a month old they invariably show this golden bay colour and are very conspicuous in the jungle. I shall refer to this phenomenon later on. I think the bay colour persists for about five or six months and then the colour of the body and the legs to the knees and hocks gradually changes into a dark sepia with light stockings and a light forehead. In most



AN OLD BULL SELADANG. HE IS JUST APPROACHING A SALT LICK.

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cases there are lightish patches of hair above the bare part of the nose, round the lips and under the chin. The illustration No. 1 of a young seladang shows a young bull, probably about twelve months old. This animal which was within thirty yards of me for a considerable time was quite dark in colour. In fact one might describe it as being dark sepia, but its legs from the knees and hocks downwards were of a very light khaki colour; the frontlet as is shown in the photograph was a greyish yellow.

These colours persist through life, except that as the animals get older the body colour becomes darker and in very old animals the frontlet becomes grey. Also with mature bulls, it is commoner to see dark khaki stockings than the light ones seen on the calves and the cows.

A mature bull seladang is a magnificent animal measuring up to 6 ft. 3½ in. at the shoulder with a length from nose to rump of between nine and ten feet. It is as the illustrations here show an animal of enormous strength and great bulk, and although I have no figures to support my estimate I do not think that a big bull seladang would weigh less than two thousand pounds. The cows are lighter build but little less in stature than the bulls and an old cow measuring 5 ft. 10 in. at the shoulder is by no means uncommon. There appear to be two distinct phases of development of the dewlap in the seladang. In some cases, mature seladang have a very pronounced dewlap, in other cases, the dewlap is hardly developed at all. I have found that seladang with heavy dewlaps are generally taller than those with little or no dewlap, have longer horns and have more light hair round the muzzle. Those with little or no dewlap are generally stockily built, but less in shoulder measurement, and although the light patch on the chin seems to be common to all seladang, those without a developed dewlap seldom have any light patch over the nose. This applies to cows as well as bulls, but the dewlap is never well developed in the cow.

It is possible that there are two subspecies of seladang in Malaya, but I have no sufficient information to enable me to express a definite opinion on the subject. The soft part of the nose of the seladang is generally dark grey, sometimes almost black, but it is never pink as is sometimes the case in the Indian gaur. The glory of a bull seladang's horns when in his prime and before the tips have become much worn, is one of nature's triumphs. The young seladang has horns yellow at the base with longish black points; as the animal gets older the bases of the horns thicken and become corrugated changing colour to a deep olive green. This happens to the horns of cows as well as bulls although the cows' horns never approach those of the bulls in length or girth. A cow's horns would very seldom reach a basal measurement of fifteen inches; bulls sometimes reach a basal measurement of twenty-two inches or more. The Malayan animal does not, as a rule, have long or wide spreading horns, due possibly to the dense jungle in which it spends most of its time, an outside spread of forty inches and a length of thirty-five inches is seldom attained.

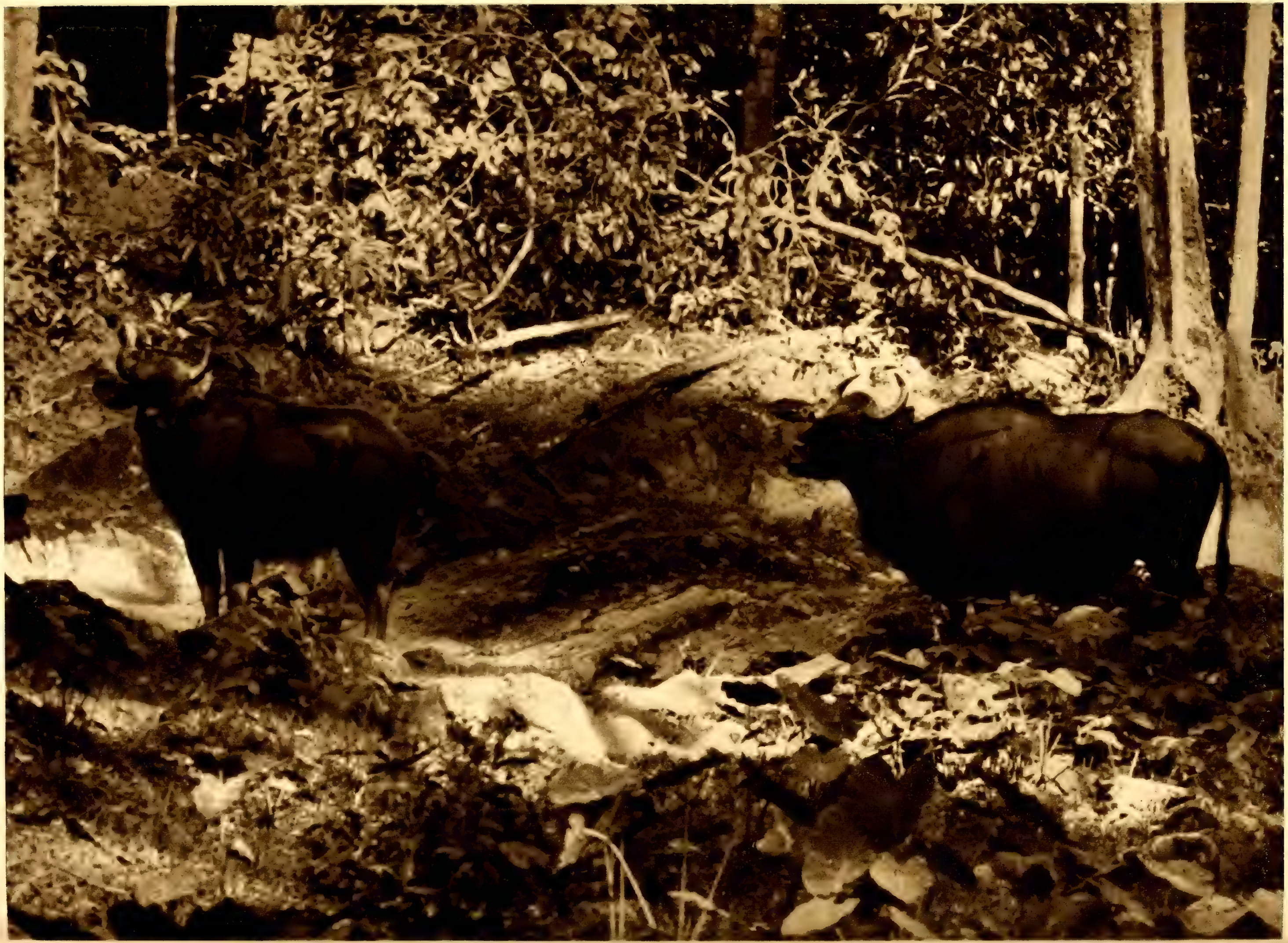
I hesitate to estimate what age a really old seladang reaches but, presuming that they reach adolescence during their fifth year, extreme old age would be reached at about their thirtieth year. I have known old bull seladang, which frequented certain tracts of country, well-known to me, which were there for many years, and this leads me to believe that seladang have a long life.

Seladang never wallow in mud baths so beloved by the Indian buffalo (*Bubalus bubalis*). The result is that they always appear, except in the case of very old animals, as if they had just been groomed. Their hides shine with a lustre which is most attractive. This is due to the fact that seladang exude an oily sweat which carries with it a brown pigmentation, especially noticeable if their bodies are wet from rain. When following seladang one is often warned of their proximity by a strong bovine scent, accentuated in the case of old bulls, and very noticeable if they have been put to much exertion, such as a long chase. An oldish animal, under such circumstances, will sweat so freely that a brown stain may be found on trees or saplings against which it has brushed, and the almost continuous scent left behind on the trees should not be allowed to mislead one into believing that one's quarry is near. The fresh scent of close proximity is distinguishable from the scent left on the trees to any one experienced in bush-craft.

I believe domestic cattle never sweat, and as *Bos indicus* (Zebu), the common domestic humped cattle of India is no exception to this rule, it seems unlikely that they were descended from *Bibos gaurus*. The origin of *Bos indicus* is unknown but was regarded by Blyth as probably African. The theory was discredited because it is known that there are no wild cattle in Africa which could have been the progenitors of the Zebu. The only wild species is the Buffalo, an animal quite apart from the Zebu. It was subsequently suggested by Professor Ruttimeyer that the remote ancestor of the Zebu was the wild Banting of Java: better known as the *Tsaine* in Burma, a theory upheld subsequently by Lyddeker. It is now held that the humped cattle of Asia in common with European cattle is descended from the aurochs or Wild Ox of Europe and that the Zebu's hump is a modification developed under domestication. The presence or otherwise of sweat glands in the skin might be a clue to the ancestry of wild or domestic cattle.

The word *seladang* is the Malayan word for the variety of gaur found in the Malay Peninsula and is probably derived from two native words, *satu* meaning one and *ladang* meaning a jungle clearing, indicating that this animal is one which may be seen in a clearing, *satu ladang*, abbreviated to sladang or seladang. Other large Malayan wild animals would not be seen in such places; a rhinoceros, an elephant, or a tapir would not be found feeding in a clearing in the daytime.

The seladang is a forest-edge animal and its habitat is not virgin forest, although it is frequently found in the forest due to circumstances which have been forced upon it. It is unlikely that the seladang is an animal indigenous to the Malay Peninsula. The following reasons seem to indicate a comparatively recent migration from the north. The entire peninsula, except the highest



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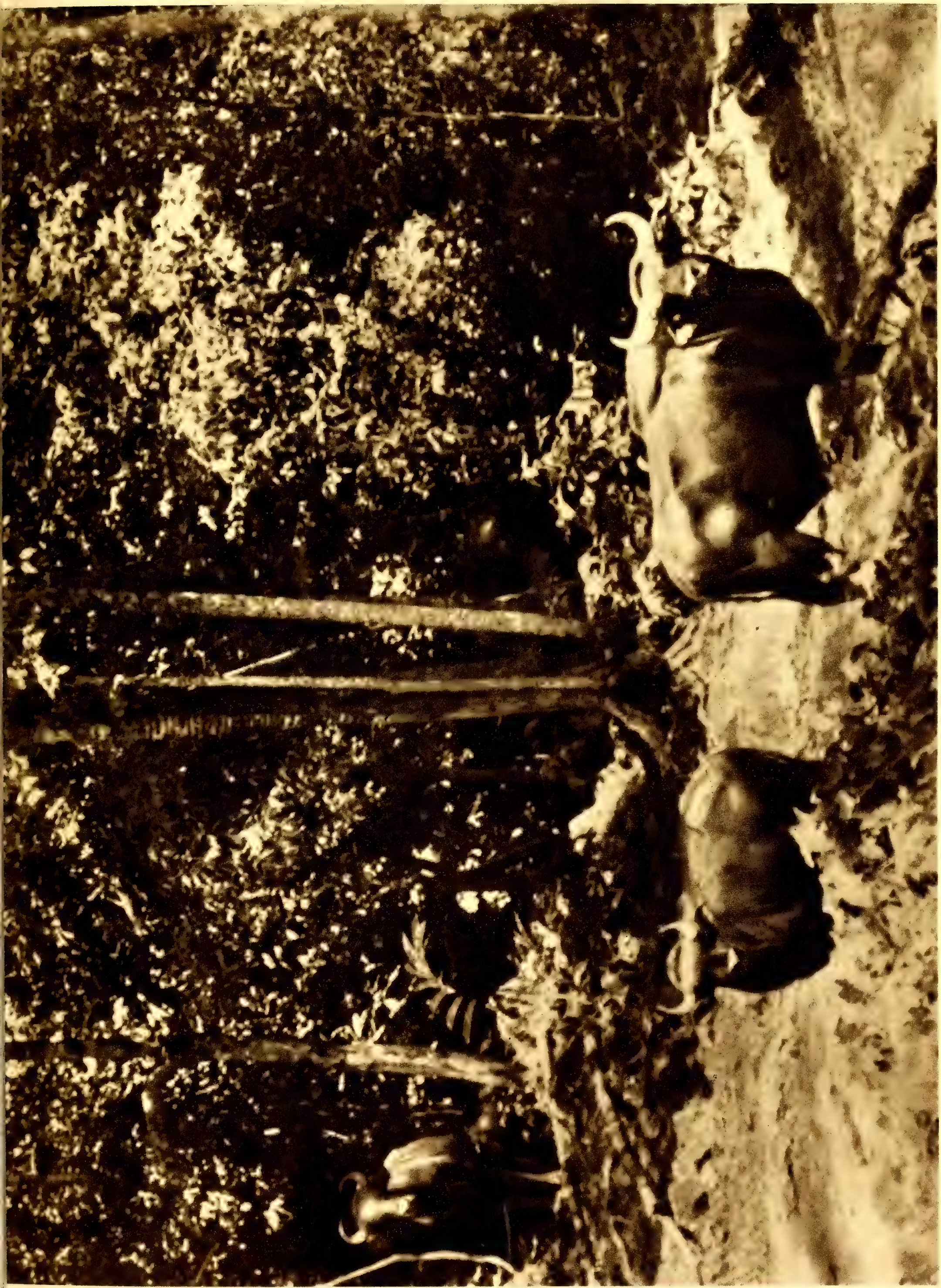
A COW SELADANG AND [illegible]
CURIOSITY SO HIGHLY DEVELOPED IN THE YOUNG

mountains, was originally covered with dense tropical virgin jungle; there were no natural clearings at all, and until Man appeared from the north there would have been nothing approaching grass land except where possibly floods had cleared some river banks of river-edge vegetation. Even now to this day no clearing remains free of jungle growth for more than a few months if left untended and in two or three years returns to a dense secondary forest. This is not the environment which would evolve the large species of *Bovidae* and it is reasonable to suppose that some centuries ago the seladang, or as they were then gaur, came down through Siam and Burma to the Malay Peninsula following the cleared spaces of the early settlers in Malaya. I advisedly write 'settlers' because certain of the aborigines who inhabited the Malay Peninsula and who still inhabit it make no clearings, merely living on roots, fruit, and anything they can catch. Such races would not have helped to provide gaur with the grasses essential to their well-being and without which they would not be attracted to a new country. The origin of the seladang in the Malay Peninsula is I think of the greatest importance when considering their habitat, environment and general reaction to those 'civilizing' influences which are so perilous to their welfare, and for those reasons we must consider carefully the artificiality or otherwise of their present existence.

There is one extremely significant fact which points to a comparatively recent immigration to the Malay Peninsula and that is the light colour of the young seladang calves. I have given this phase of the subject much thought; I have made as careful observations as are possible on wild animals which can seldom be seen except in dense cover; I have seen many scores of young seladang calves; and have drawn the following deductions. That seladang have not yet adapted themselves completely from a physical standard to their environment in which they have to live in the peninsula because a bright bay coloured calf is not able to achieve that concealment in the forest, even when immobile, which Nature generally provides to the young of many species and to the adults of some species, as a protection against enemies. In grass country, which I think is the true habitat of *Bibos gaurus,* a light coloured calf in times of danger would be well concealed when lying or squatting down, and it is this very habit of squatting down when suddenly startled—not of course at very close quarters when panic would lead to flight—that the seladang calves practise even in virgin jungle. I could give many instances but the following will suffice. I had disturbed a herd of five or six seladang on the edge of an old clearing which had grown up into a coarse rank grass called *lalang* (*Imperata arundinacea*). Amongst these seladang was a young calf—a bright golden bay calf. We followed the herd and saw that the tracks of the calf were not there. We returned to the edge of the clearing looking round about for the calf but could see nothing. Presently one of my men spotted the calf on the edge of the jungle looking towards us. It almost at once disappeared from view and I felt certain that it had squatted down for concealment. We walked slowly over to where the calf had been and almost reached the edge of the jungle when the calf jumped up five or six yards from us and dived into the jungle. It only sought safety in flight when we were very close to it. The cows almost invariably leave the calves to take care of themselves on the assumption I suppose that immobility is a better safeguard for the calf than flight with the herd. I have never known a cow seladang stand by her calf, but the calf will remain more or less in the same place until the mother returns for it, calling in a soft low moo until the calf hears it. I think it may often be hours before the cow returns, especially if much alarmed. These peculiar tactics of the seladang, not at all suitable to its environment in Malaya, no doubt account for a large mortality amongst the calves from tigers, who will certainly know, if I do, that a stampeded herd is liable to leave the calves behind. Here we have one factor against the seladang, owing to an incomplete adaptation to a new environment.

In the Malay Peninsula seladang herds are few and scattered and it is more than likely that the ten or twelve animals in a herd very seldom meet any seladang from another herd. This would make one suspect a great risk of too much inbreeding, but I think Nature has ways and means of getting over such difficulties which we seldom suspect. It has seemed to me from long observation that there is a predominance of males in each herd. I put this forward with some diffidence because it is difficult to tell the young bulls from the young cows and I may have been mistaken in my deductions, but, if I am right, this would, to some extent, help to prevent too close inbreeding. Another phase in the life history of seladang is the frequent absence from the herd of quite young bulls, who will leave the herd for days or weeks, and then return to the fold. I do not hold the view that these young solitary bulls have been driven away from the herd by a more powerful bull, which is what is generally supposed. I believe that seladang are naturally independent and that males are liable at any time to go off by themselves. I have seen quite young bulls three or four years old, miles away from a herd; such youngsters would not have been forced or driven out of a herd. I have known of three young bulls, of which the oldest was not more than five years, away from any others, thoroughly enjoying themselves in a salt lick. They certainly had not been kicked out of a herd *en masse,* but were, I believe, merely following their natural inclination for wandering adventure. This proclivity to wander off by themselves may also help to check too close inbreeding, because young, middle aged and old bulls all do it. Again old bulls are supposed to become entirely solitary, having been driven out from the herd, to live a retired and morose existence. This I do not believe either, although a very old bull will be more frequently by himself than with a herd. Still one finds very old bulls with herds as the photograph opposite clearly shows. So it is more than likely that the mature cows in a herd are not always served by the same bull, because even supposing that the master bull is the strongest one in the herd his habit of going off by himself may at times coincide with a cow's desire for a mate and so some other bull



OLD BULL SELADANG TAKEN WITH A HERD IN A SALT LICK.

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in the herd may be the sire of her next calf. Old bull seladang have a peculiar habit of attaching a young bull to them who is often found in their company. I have come across several cases of this and illustration opposite shows an old bull, with a young bull, in attendance. But this old bull, whose tattered ears make him easily identifiable, is also to be found in a herd as the next illustration shows (vide plate facing p. 14). I have often thought that this 'attendant' is picked up to help an old bull to look after himself, because undoubtedly old bulls frequently become deaf and a companion can make up for their deficiency by acting as a watchman. I once came across a case of a sambhur stag which attached itself to an old bull seladang, but what was the natural attraction I do not know.

I believe very old seladang whose strength has greatly decreased, sometimes fall victims to tigers. I know, at present, of one old bull seladang, obviously very nearly at the end of the trail, who is frequently attended by a very large tiger whose presence is decidedly not to the advantage of the seladang.

Seladang do not appear to have any special breeding season, calves being born at almost any time of the year. During the wettest months in Malaya, October to December, very young calves are seldom seen, although considering it is the cow that comes in season not long after the calf is born and the gestation period is nine months there appears to be no reason why one month should be more favoured than another month. I think seladang cows seldom have more than one calf during the season as I have never seen, except on one occasion, two calves following a cow. On the occasion when I did see two calves attached to a cow, they were each about twelve months old and only one of them may have belonged to the cow, the other may have lost its mother.

Seladang are extraordinarily sensitive to disturbance and will not thrive in country which is continually invaded by Man. In Malaya that has accounted for the almost entire disappearance of seladang from the west coast and from many places on the east coast. It is doubtful if four hundred seladang exist in the Malay Peninsula and of these at least twenty-five per cent., owing to their isolated positions, are sure to disappear in two or three decades. It is all the more necessary therefore to do our utmost to preserve intact those herds which are now in wilderness country. Unless great care is taken seladang will be exterminated in Malaya. Seladang are not mountain animals and although in their many wanderings solitary bulls will go far into the mountain country a herd does not do so, and land consisting of undulating country and river valleys must be preserved intact for their contentment. Therein lies the difficulty in Malaya where irrespective of true economic principles the habitat of wild life is often ruined for some purely ephemeral benefit. National Parks and Reserves are the only hope of salvation for the seladang of Malaya, and I will deal with this aspect of the question later on.

The seladang is by no means voiceless. It has no less than five distinct and characteristic methods of expressing its emotions.

The one most commonly heard is the snort of alarm and surprise which is given by seladang when met at close quarters. This snort is made by a violent and rapid expulsion of air through the nostrils and is one of the terrifying phenomena referred to by Malays when describing the extreme ferocity of the seladang. This snort is supposed to precede an imminent attack and is immediately followed by flight on the part of the Malay who describes with vivid detail on reaching his village how he was charged by a seladang and only by his extreme agility was he able to save his life. What actually happens is that the seladang is terrified as well as the Malay—he probably could not be terrified as much as the Malay—and the snort is immediately followed by a quick turn and precipitate flight.

The second sound made by the seladang is of the same class but is made when a bull is explaining to the rest of the herd what a fine fellow he is, or when he is demonstrating to a tiger, which may be in the vicinity, that he is quite ready for a fight if the tiger comes within reach of his horns. These sounds are chiefly whistling snorts made through the nose as in the first instance, but generally accompanied by butting at the undergrowth and by pawing up the ground. During these demonstrations seladang are liable to demolish ant hills with their horns, but this is sometimes due to attempts to remove ticks from their heads. This habit wears down the tips of the horns in some cases, although not invariably. I have obtained old seladang with perfect tips to their horns. It is I think a matter of temperament.

The third sound is that of a cow seladang calling to her calf, which in most cases almost exactly represents the moo of domestic cattle but sometimes may be likened to a mild rendering of a fourth sound which I will presently describe. This noise is only made by the cow calling to a younger animal.

The fourth sound is the most peculiar sound made by seladang. It is a call to other seladang which may be in the vicinity and is a sound beyond my powers to describe. It is a cross between the bugling of a wapiti (elk) and the trumpeting of an elephant. It is a melodious sound which carries a long way in the jungle. I have heard a young seladang calling when waiting in the jungle within a short distance from a salt lick, waiting to go into the lick but probably not wishing to enter alone. It was in more or less the same position for about two hours and during that two hours called four or five times. It had a fairly deep note and I thought that it was a mature bull calling to the rest of the herd, but at the end of two hours when it plucked up courage to enter by itself, lo and behold ! this animal which I had taken for a mature bull was a young bull of not more than two or three years of age !

The final sound made by a seladang does I believe only occur once, and that is at the end of its life when it is dying a violent death. It is a dying moan which once heard will never be forgotten, and might be taken as a protest against the deprivation of its life while still strong and vigorous.

The main food of seladang consists of grasses of which the

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OLD BULL SELADANG WITH YOUNG BULL IN ATTENDANCE.

one they like best is known in the vernacular as *rumput chengkenit*. This is a creeping grass common throughout the Malay Peninsula and is cut a great deal for cattle food. *Lalang* and allied coarse grasses are also eaten by seladang when they are young. Clearings which are grown up into *lalang* are often burnt off to attract seladang. In the jungle they do not eat many of the leaves of jungle trees but one tree they are very fond of is *merlimau* (*Atalantia monophylla*). The leaves of trees which grow in secondary jungle, *mengkirai* (*Trema amboinensis*) and *beti-beti* (*Eugenia zeylanica*) are much liked by them. Seladang occasionally raid crops but never crops that are properly looked after or taken care of. They will eat young rice which is of course like any other young succulent grass and will also eat the leaves of young Indian corn, but as a potential danger to cultivation which is properly taken care of the seladang may be ignored. Seladang are very fond of visiting salt licks especially sulphur licks and it is due to the fact that they will visit these licks during the day time that the photographs illustrating this article have been made possible. In the Malay Peninsula there are no open spaces in which one is the least bit likely to find seladang during the brighter hours of the day although one might occasionally see them in the early morning or evening. The sulphur or saline found in these salt licks are taken I think by seladang to clear their stomach of intestinal parasites. In some cases where seladang have visited a mud lick I have seen their droppings almost pure mud, and I think that these licks must be considered as the chemists' shops of these animals. In places where they are undisturbed seladang are liable to visit a salt lick at any time of the day or night, but unfortunately such places in the Malay Peninsula are few and far between and most visits to salt licks are made during the hours of darkness. For many decades when visiting salt licks seladang have been subject to being fired at by Malays safely ensconced in the shelter of high trees with the result that such places are generally avoided during the hours of daylight. Even where there is no disturbance and the seladang have a sense of security the approach to a lick will still be made with the greatest caution and an animal about to enter a lick will generally wait at the edge of the jungle for some minutes before finally entering the lick. Very old bulls are an exception to this rule because they do not seem to care for anybody or anything and walk straight into the lick to have their drink which may take them a long time, perhaps a quarter of an hour, and then walk away without any concern.

With two or three exceptions no expert or intelligent observations have ever been made on the ecology of the seladang. The result of this has been that seladang have been judged by native gossip and have been credited with a ferocity and aggressiveness entirely foreign to their character. A big seladang if met in the jungle *looks* ferocious and has the same psychological effect on a native as the horrible effigies on blatant banners, carried in the van of an army, had on Chinese soldiers in ancient days.

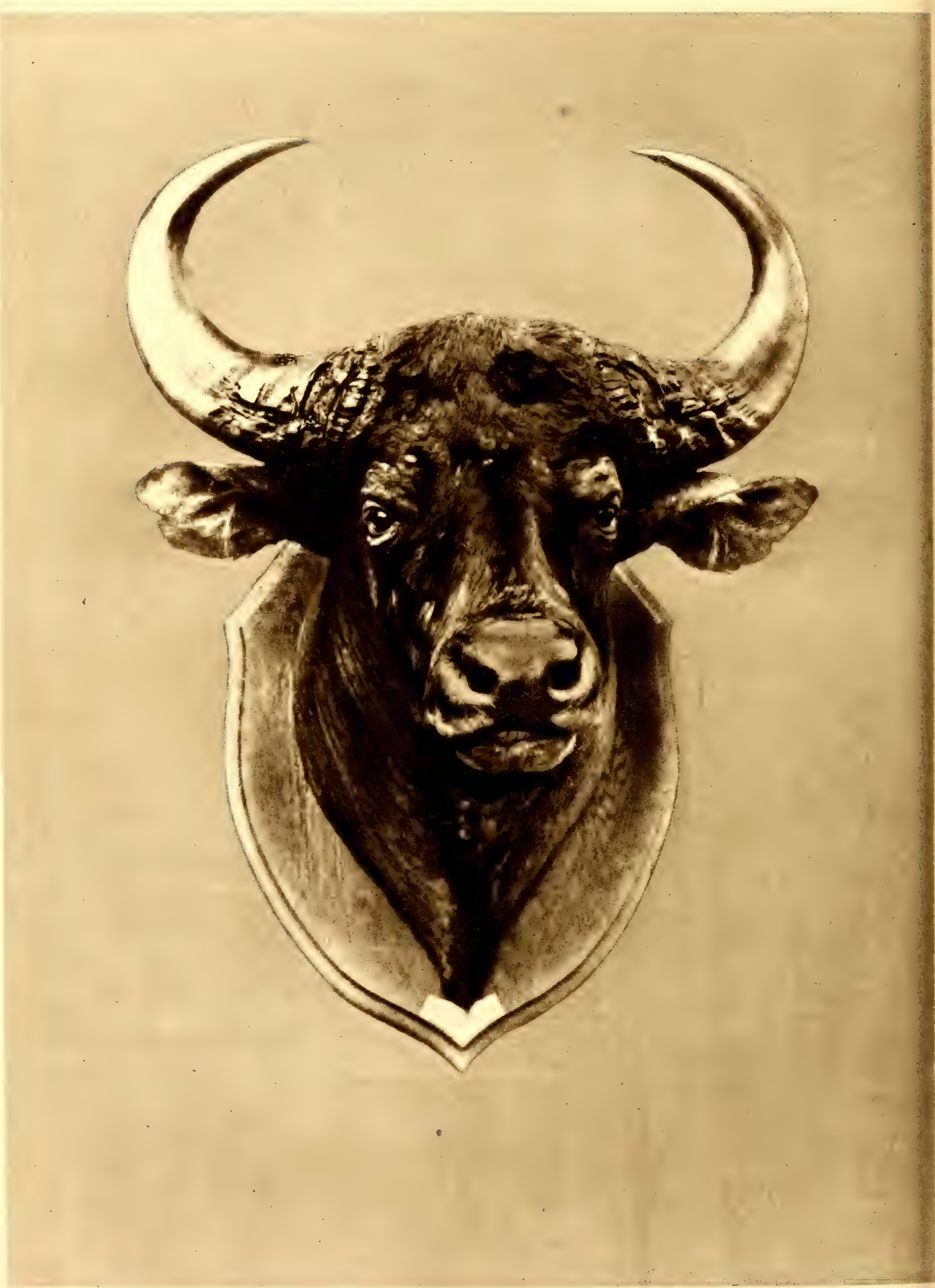
The seladang is in reality an exceptionally quiet and well-behaved wild animal, so far as Man is concerned timid to a degree and not, so far as I know, intolerant of the presence of other animals. I have a photo of a doe sambhur (*Cervus unicolor*) in close proximity to a cow seladang and apparently unnoticed by a young bull seladang who has with great impoliteness turned his back on the doe, supports, to some extent, my contentions. In this case the doe sambhur came across my front—I was in a hide—and walked quietly up to where these two seladang were drinking in a salt lick. Presently the seladang detected a slight taint in the wind and went off in a hurry, but this did not disturb the doe although she immediately became suspicious and 'froze' into an expectant attitude which she maintained for quite a quarter of an hour. But that is another story.

I have often seen seladang and sambhur deer in this salt lick at the same time within twenty or thirty yards of each other, but only on this one occasion in such close proximity.

Bull seladang do, of course, at times fight. I have shot many seladang with new and old scars on them but although, in my time, I have tracked on foot seladang for thousands of miles I have never come across a single place where a fight had taken place. Signs of demonstrations I have frequently seen, but they appeared to lead to nothing in the way of a 'scrap'.

I only know of one authentic case of a bull seladang being found dead after a fight to the death with another bull, but I did not personally see the site of the affray.

Amongst the big game of Malaya seladang, as a sporting animal, is in a class by itself. Although rhinoceros hunting may be more difficult it is much less easy to obtain, and few Europeans have ever made any attempt to hunt rhinoceroses in the Malayan jungle. The seladang has been fairly widely distributed throughout Malaya and has been hunted a great deal at different times by both Europeans and natives. Unfortunately the seladang is an animal which may occasionally be shot by waiting for it in the evening in a burnt off clearing or in some old estate where there is little disturbance and where these animals occasionally come out to feed. Seladang shot under such conditions are fired at in much the same way that one would shoot at a target and trophies obtained in such a way in no way reflect any credit on the ability of the hunter. On the other hand those who have tracked seladang in the jungle and have finally outwitted an animal which is especially alert when in dense jungle will enjoy hunting and tracking equal to anything to be obtained elsewhere. As I have said already it is by no means certain that because an animal is a solitary one it is therefore a desirable trophy, although it is unlikely that such an animal would be a cow. But any hunter after some experience soon gets to know the difference between the big track of a big young bull and the big track of a big old bull. Very often they are much the same length but they are not the same shape, the older track is wider at the heel, more blunt at the tip and does not show an impression of the outer edge of the hoof seen in the younger track. This perhaps is scarcely the place in which to write a long dissertation on the hunting of seladang, but entirely apart from the great scientific interest attaching to an animal such



OLD BULL SELADANG—KRAU VALLEY, PAHANG, F.M.S.

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as a seladang it must be remembered that the fact of an animal carrying a desirable sporting trophy goes a long way towards insuring that it will not be ruthlessly exterminated. At least that applies in most countries but not very strongly in Malaya where now-a-days few white men take any interest in the hunting of big game. The seladang is extraordinarily difficult to pick up in a dense jungle. It will, like all jungle animals, remain absolutely immobile directly it is suspicious that there is something abnormal in its vicinity and in the dense jungle where it will be found one's vision is confined to a circle of anything from ten to twenty-five yards—it is almost impossible to see a dark animal like the seladang so long as it keeps still. Under such conditions the seladang's first move which may or may not be preceded by a violent snort is to swing round and disappear. I am presuming that the hunter is on the tracks of a solitary animal. A long stern chase of some hours will then take place and will probably be followed by an exactly similar circumstance. If the first approach to the seladang is not successful every subsequent approach will be more difficult. They are extraordinarily alert and until very old have good hearing and good eyesight. Their powers of smell are phenomenal, and the slightest taint in the wind will send them off at once. So to be a successful seladang hunter one has to be a persistent person, but the reward will come because some day either the hunter gets an unexpected piece of luck or the seladang makes a mistake and awaits in a place where he thinks he is concealed but not sufficiently concealed to deceive the hunter. Or possibly the hunter's skill may exceed the seladang's caution, and the animal may be caught unawares.

I remember having a long hunt after a very old bull seladang. In fact I was on his tracks for four days. We came up to him several times but he was always aware that we were there before we were aware where he was. He never ran away—perhaps his running days were past—but he immediately walked off and kept on walking for hours. At last in the middle of the fourth day he made a mistake and I was able to obtain one of the finest trophies that I have ever got. The illustration opposite shows the mounted head. The mistake he made was this. He had gone up a steep hillside and we were tracking him when we heard the heavy breathing of the seladang above us on our right front. We stopped and presently saw that the seladang was coming down the hill towards us, but before we could see him properly he also stopped and although I could see where he was I could not tell which end was which. He was equally mystified. He realized that there was something wrong somewhere down the hill below him but did not know what it was. I dared not fire for fear of hitting the wrong end. He was more or less sideways to me. Presently he put his head down close to the ground to look under the undergrowth to see what it was that was bothering him. The moment he put his head down I of course knew which end was which. Had he not put down his head but moved off I should not have had a chance of killing him. He was about thirty yards above me up a very steep hillside.

I have followed seladang often for several days and they have given me a great deal of wonderful hunting. Despite the fact that a seladang is an enormously bulky animal, and an extremely active animal except when very old, he seldom attacks a hunter even when wounded. I have several times been in such a position when following a wounded seladang that he could have almost certainly made good a charge had he elected to be aggressive. But flight was more to his liking. Only once have I had a near call and on that occasion the animal, badly wounded, came all out to try and get some of his own back. In fact he was so close to me that my shot hit him in the head at about five yards from me and the impetus of his rush carried the body past me.

But seladang hunting in the Malay Peninsula is nearly a thing of the past because although there are still seladang the country is now highly commercialized and seladang will not thrive where they are continually disturbed.

What of the future of the seladang? I wish I could find an answer. Although persistent efforts have been made during the last few years to awaken a lethargic Government to the importance of properly enforcing the Game Laws and of taking proper steps to provide sanctuaries and refuges for the wild life of Malaya, nothing has been placed on a sound foundation, and it is extremely doubtful if it ever will be placed on a sound foundation. Officials who look at the balance sheet of an annual budget hate the idea of allowing a tract of country, which may contain some mineral or some timber or something else that will produce money, being tied up to propagate wild life, and it is difficult to get the realization of the value of wild life into the mentalities of persons who are merely ephemeral office holders. In Malaya nearly the entire population consists of Malays, or Chinese, or Indians. The Malays are the indigenous people, but they do not care a single thing from an ethical point of view about the wonderful natural resources of the country. The others, including most of the Europeans, are here to get what they can out of the country, and without a realization of the necessity for a sound policy regarding the conservation of the natural resources of the country as a matter of ethics wild life conservation in Malaya will fail. It is useless to appeal on the grounds that in a few decades the natural resources of the country will be ruined, because those who are sufficiently intelligent to understand that know perfectly well that they will not be here. The Europeans in Malaya are birds of passage; the indigenous races cannot grasp the value of the wild life to their country. The only hope for the larger fauna of Malaya, seladang in particular, is to make inviolable sanctuaries and unless we can get inviolable sanctuaries, sanctuaries which will not be carved up to allow Mr. A to prospect or mine for gold, Mr. B to prospect or mine for tin, or Mr. C to exploit the timber, the larger wild life is doomed.

There are areas in Malaya which have been set aside and are at the moment ostensibly refuges for wild life, but it is a continual fight to get money or personnel to guard these places, and it is only a matter of time when, if the present apathy continues, it will be considered not worth while. It is a deplorable thing to realize the fact, as I can from personal experience realize it, that during the last forty years in Malaya the larger forms of wild life have been so depleted that they are in grave danger of extermination, and so long as Malaya worships the cult of Mammon before everything else, it is difficult to see how matters can sufficiently improve to retrieve the situation.

FISH OF DEOLALI.[1]

BY

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PART III.

(*With three plates and* 6 *text-figures*).

ON TWO NEW SPECIES AND NOTES ON SOME OTHER FORMS.

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INTRODUCTION AND LIST OF SPECIES.

In the first article of the series[2] a general account of the localities and lists of specimens obtained therefrom were given, and here we propose to give a complete list of the fish-fauna of Deolali, to describe the two new species of *Barbus* and *Parapsilorhynchus*, and to add notes on certain species whose existing descriptions require amplification. In preparing the following list we have adopted the classification proposed by Jordan,[3] and have given the Bhil names of the various species as supplied to us by Mr. A. G. L. Fraser. Information regarding the distribution of the different species of fishes in Deolali waters is also incuded in the list.

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[1] Published with permission of the Director, Zoological Survey of India.

[2] Hora and Misra, *Journ. Bom. Nat. Hist. Soc.*, xxxix, pp. 502-519 (1937).

[3] Jordan, *Classification of Fishes* (Stanford University, California: 1923).

Scientific Name	Bhil Name	Local Distribution[1]
Order: ISOSPONDYLI		
Family: NOTOPTERIDÆ		
1. *Notopterus notopterus* (Pallas)	Chambaree ...	6 and 38.
Order: OPISTHOMI		
Family: MASTACEMBELIDÆ		
2. *Mastacembelus armatus* (Lacép.)	...	38.
Order: APODES		
Family: ANGUILLIDÆ		
3. *Anguilla anguilla* (Ham.)...	Ahhir ...	38.
Order: EVENTOGNATHI		
Family: CYPRINIDÆ		
Sub-Family: ABRAMIDINÆ		
4. *Chela clupeoides* (Bloch) ...	Phal, Phathree, or Pathree ...	3, 4, 6, 8, 12, 16, 20, 21, 22, 23, 26, 30, 31, 41, and 49.
5. *Chela phulo* (Ham.) ...	Gayroonjee or Phal ...	6, 22, 23, 40, and 42.
Sub-Family: RASBORINAE		
6. *Barilius bendelisis* (Ham.)...	Waris, Jhor or Jhoria ...	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 19, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46, 47 and 50.
7. *Danio æquipinnatus* (McClelland)	Gayroonjee ...	3, 6, 9, 10, 13, 18, 23, 27, 29, 31, 33, 34, 35, 38, 39, 42 and 43.
8. *Danio fraseri* (Hora) ...	Gayroonjee ...	5 and 7.
9. *Rasbora daniconius* (Ham.).	Gayroonjee ...	7, 8, 9, 10, 11, 12, 14, 16, 18, 19, 22, 23, 29, 31, 33, 35, 36, 38, 40, 41, 42 and 44.
10. *Rasbora labiosa* Mukerji ...	Gayroonjee ...	1, 2, 4, 6, 10, 13, 15, 24, 25, 26, 34, 35, 39, 45 and 50.

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[1] The numerals given in this column refer to the locality numbers corresponding to those given in the first part of this series (*Journ. Bom. Nat. Hist. Soc.*, xxxix, pp. 502-519, 1937).

Scientific Name	Bhil Name	Local Distribution
Sub-Family : CYPRININÆ		
11. *Aspidoparia morar* (Ham.).	Sandokol, Phal, or Ambli ...	6, 8, 33, 41 and 42.
12. *Barbus amphibius* (C. & V.).	...	16, 18, 22, 30, 31 and 40.
13. *Barbus chola* (Ham.) ..	Bhokria ...	8 and 12.
14. *Barbus chrysopoma* (C. & V.)	Bhodeer ...	16.
15. *Barbus khudree* Sykes ...	Waris ...	5, 6, 8, 9, 19, 20, 21, 23, 26, 27, 28, 33, 36, 40, 41, 42, 46, 47 and 48.
16. *Barbus kolus* Sykes ...	Bhokria or Kholis ...	6, 8, 9, 12, 16, 19, 20, 21, 23, 28, 36, 38, 40, 41, 46, 47, 48 and 49.
17. *Barbus melanostigma* Day ...	Gayroonjee ...	19 and 47.
18. *Barbus parrah* (Day) ...	...	46.
19. *Barbus pinnauratus* Day ...	...	19, 22 and 31.
20. *Barbus sarana* (Ham.) ...	Bhodeer ...	20, 21, 22, 26, 30, 38, 41, 42, 47, 48 and 49.
21. *Barbus ticto* (Ham.) ...	Tiplee or Tiptoo.	3, 4, 5, 6, 7, 8, 9, 10, 12, 16, 19, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 39, 40, 41, 43 and 44.
22. *Barbus fraseri*, sp. nov. ...	...	6, 8 and 12.
23. *Cirrhina reba* (Ham.) ..	Arrol ...	38 and 40.
24. *Crossochilus latius* (Ham.).	Warootee ...	22, 23 and 41.
25. *Garra mullya* (Sykes) ...	Mallia or Kharandya ...	3, 9, 10, 13, 16, 19, 22, 23, 24, 25, 26, 27, 28, 29, 31, 33, 35, 36, 39, 40, 41, 42, 44, 45 and 47.
26. *Labeo boggut* (Sykes) ...	Sandekol ...	3, 6, 19, 23, 38, 40, 41 and 42.
27. *Labeo calbasu* (Ham.) ...	...	16.
28. *Labeo porcellus* (Heckel) ...	Khanoos, Kholis or Goghree ...	16, 17, 22, 36, 38, 46, 47, 48 and 49.
29. *Parapsilorhynchus prateri*, sp. nov.	...	1, 4, 10, 13, 14, 35 and 50.
30. *Rohtee cotio* (Ham.) ...	Goorda ...	6, 8 and 23.
31. *Rohtee alfrediana* (C. & V.).	...	22 and 31.
32. *Rohtee vigorsii* Sykes ...	Kaplee ...	46 and 49.
Family COBITIDÆ		
33. *Lepidocephalichthys guntea* (Ham.)	Mhorro, Mohroo Thail or Mohroo Chapra ...	6, 8, 10, 12, 13, 14, 24, 25, 29, 30, 34, 35, 39, 40 and 45.
34. *Nemachilus botius* (Ham.).	Mhorroo or Mohroo Chickna ...	5, 6, 8, 9, 12, 23, 26, 27, 31, 33, 36, and 40.
35. *Nemachilus denisonii* Day.	Mhorroo or Mohroo Yaree.	1, 5, 6, 10, 12, 13, 24, 34, and 39.
36. *Nemachilus evezardi* Day ...	Mhorro ...	13, 14, 23, 24, 34 and 35.

Scientific Name	Bhil Name	Local Distribution
Order : NEMATOGNATHII		
Family : SILURIDÆ		
37. *Callichrous bimaculatus* (Bloch)	Moonee	8 and 40.
38. *Wallago attu* (Bloch)	Baloo	20, 21 and 46.
Family : HETEROPNEUSTIDÆ		
39. *Heteropneustes fossilis* (Bloch)	......	12.
Family : BAGRIDÆ		
40. *Mystus cavasius* (Ham.)	Khirkirya	12, 16, 17, 22, 31, 40, 46 and 49.
Family : SISORIDÆ		
41. *Glyptothorax annandalei* Hora	Khordoo	23.
42. *Nangra viridescens* (Ham.).	Bibua	19.
Family : SCHILBEIDÆ		
43. *Proeutropicthys taakree* (Sykes)	......	6 and 8.
Order : LABYRINTHICI		
Family : OPHICEPHALIDÆ		
44. *Ophicephalus gachua* (Ham.)	Dakhia or Dhakaray	1, 5, 9, 10, 12, 23, 31, 33, 35 and 40.
45. *Ophicephalus leucopunctatus* Sykes	Murral	38.
46. *Ophicephalus marulius* Ham.	Murral	8, 12 and 40.
Order : PERCOMORPHI		
Family : AMBASSIDÆ		
47. *Ambassis baculis* (Ham.)	......	6 and 40.
48. *Ambassis nama* (Ham.).	Goorda or Bing.	4, 6, 22 and 40.
49. *Ambassis ranga* (Ham.)	Bing	4, 6, 12, 16, 20, 21, 22, 23, 26, 30, 31 and 40.
Order : GOBIOIDEA		
Family : GOBIIDÆ		
50. *Glossogobius giuris* (Ham.).	Kharbia or Kharbya	12, 16, 19, 20, 21, 22, 23, 26, 36, 40, 47 and 48.

It is seen from the above that in Mr. Fraser's collection of 4,463 specimens there are representatives of 50 species. Of these

29 belong to the family Cyprinidae, 4 to Cobitidae, 3 to Ophicephalidae, 3 to Ambassidae, 2 to Siluridae, 2 to Sisoridae and 1 each to Notopteridae, Mastacembelidae, Anguillidae, Heteropneustidae, Bagridae, Schilbeidae and Gobiidae. The abundance and variety of Cyprinoid and the comparative rarity of the Siluroid fishes are noteworthy features of the fauna. Even from the point of view of the local distribution of the species, the Cyprinoids are found practically everywhere and no doubt form the major portion of the fish diet of the local inhabitants.

SYSTEMATIC ACCOUNT.

Chela clupeoides (Bloch).

1878. *Chela clupeoides*, Day, *Fish. India*, p. 602.

In his account of *Chela clupeoides*, Day referred to the variability of the species with regard to lepidosis and number of rays in the anal fin. Though as a rule the number of rays in the anal fin is stated by him to vary from 13 to 15 $\left(\frac{2}{11-13}\right)$, in the specimens from Deccan he found them to be $\frac{2}{13-15}$. A detailed examination of Deolali examples fully bears out Day's results. In a majority of the specimens the number of rays in the anal fin is more than 15 and in some of the examples there are even 18 rays.

Barbus khudree Sykes.

1841. *Barbus khudree*, Sykes, *Trans. Zool. Soc. London*, ii, p. 357.

The precise systematic position of Sykes' *Barbus khudree* has not been properly understood so far, and the reason for this seems to be the great confusion that prevails regarding the species, races and varieties of the large-scaled Barbels of India, popularly known as 'Mahseers'. Unfortunately Sykes did not publish a figure of this species and his description contains no reference to scale counts. He characterised it as:

> 'A *Barbus*, with 4 *cirri*; blood-stained fins; large hexagonal scales; elongated body; and with 14 rays in the dorsal, 14 in the pectoral, and 7 in the anal fins.'

The above is a generalised definition and is not helpful in distinguishing the species from a large number of similar fishes found in Indian waters. Sykes' detailed description of the species given below is also very vague. He stated:

> 'Dorsal fin of from 10 to 12 rays; first long ray a thick strong bone, with 3 very short bones before it; the whole four compact: pectoral fin of 12 perfect rays, and 2 incomplete rays, ventral fins of 9 rays; anal fin of 7 rays: tail forked, of 18 rays, besides 4 short rays outside the longest rays:

scales large, hexagonal, and of a silvery bluish-green colour: mouth furnished with 4 short feelers: anal, ventral and pectoral fins tipped with blood-colour. Lateral line concave, below the centre, and corresponding to the arch of the belly: the scales along the lateral line emarginate. Length, 10 inches; height, 2¾ inches; greatest length, a foot and a half; weight, from half to three-quarters of a seer. This fish has a considerable resemblance in form, size and habits, to the *Cyprinus Mrigala* of Dr. Hamilton; but its blood-stained fins, 4 feelers, and the discrepancies in the number of its fin-rays, sufficiently distinguish it. It is sweet and agreeable food. The same fish, under varied circumstances of age, has the fins tipped with bluish instead of red.'

'Found in the Mota Mola river, 8 miles east of Poona.'

Bleeker[1] included *B. khudree* in his list of the fishes of India without any comments, but Jerdon[2], who also had no specimen of the species for examination, remarked that 'If Colonel Sykes had not given 14 rays to the dorsal fin I might have considered it the same as *B. Hamiltonii.*' Günther[3] definitely assigned it to the synonymy of *Barbus mosal* (Hamilton). Among the specimens of *B. mosal* in the collection of the British Museum, Günther mentions a 'Young: in bad state. Dekkan. From Col. Sykes' collection'. Day[4] doubtfully referred Sykes' species to his *B. neilli,* but his conclusion is not justified, for in the latter species the last undivided ray of the dorsal fin, though osseous and entire, is very weak.

In 1936, Hora and Mukerji[5] discussed the precise specific limits of Hamilton's[6] large-scaled Barbels—*Barbus tor, B. mosal* and *B. putitora*, and showed that the last two species are synonymous. In the same year, Hora[7] discussed the relationships of the large-scaled Barbels of Assam and recognised among them two species described by McClelland[8]—*B. progeneius* and *B. hexagonolepis*—besides Hamilton's two species referred to above. An examination of a large series of specimens of the large-scaled Barbel collected by Mr. Fraser has convinced us that the South Indian form is distinct from the North Indian species and, so far as it is possible to judge, seems to represent Sykes' *B. khudree.* For convenience of reference in future, we give below a detailed description of the species from fresh specimens.

D. 4/9; A. 2/7; P. 15; V. 9; C. 19; L.l. 25-27.

Like the typical *Mahseer* of Northern India—*Barbus putitora* (Hamilton)—*B. khudree* possesses a graceful, trout-like form in which the dorsal and the ventral profiles are only slightly arched and the body tapers towards both ends, but more so anteriorly. The length of the caudal fin is almost equal to the length of the head which is contained from 4.1 to 4.8 times in total length and from 3.1 to 3.8 times in the length without the caudal. Both these structures are proportionately longer in the young individuals. The depth of the body is also more or less equal to the length of the head, being contained from 3.4 to 3.9 times in the length without the caudal. The width of the head is contained from 1.5 to 1.8 times and its height from 1.3 to 1.5 times in its length. In young specimens the eye is proportionately very large and is situated almost in the middle of the length of the head. During growth, however, it becomes confined more and more to the anterior half

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[1] Bleeker, P.—Nalezingen op de ichthyologische fauna van Bengalen en Hindostan. *Verh. Bat. Gen.*, xxv, p. 60 (1853).

[2] Jerdon, T. C.—On the Fresh Water Fishes of Southern India. *Madras Journ. Lit. Sci.*, xv, p. 313 (1848).

[3] Günther, A.—*Catalogue of the Fishes in the British Museum,* vii, p. 130 (London: 1868).

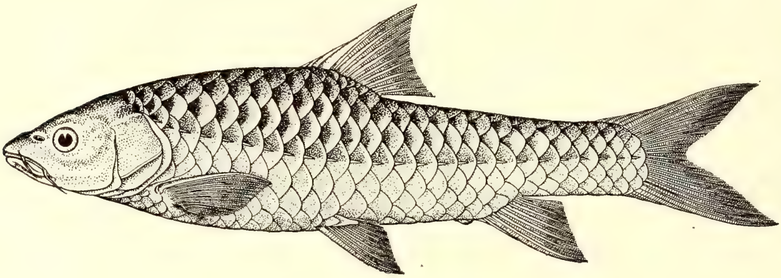
[4] Day, F.—*Fishes of India*, p. 569 (London: 1878).

[5] Hora, S. L. and Mukerji, D. D.—Fish of the Eastern Doons, United Provinces. *Rec. Ind. Mus.*, xxxviii, pp. 139-142 (1936).

[6] Hamilton, F.—*Fish Ganges*, pp. 303-307 (Edinburgh: 1822).

[7] Hora, S. L.—On a further collection of Fish from the Naga Hills. *Rec. Ind. Mus.,* xxxviii, pp. 324-331 (1936).

[8] McClelland, J.—Indian Cyprinidae. *As. Res.*, xix, pp. 332-340 (1839).



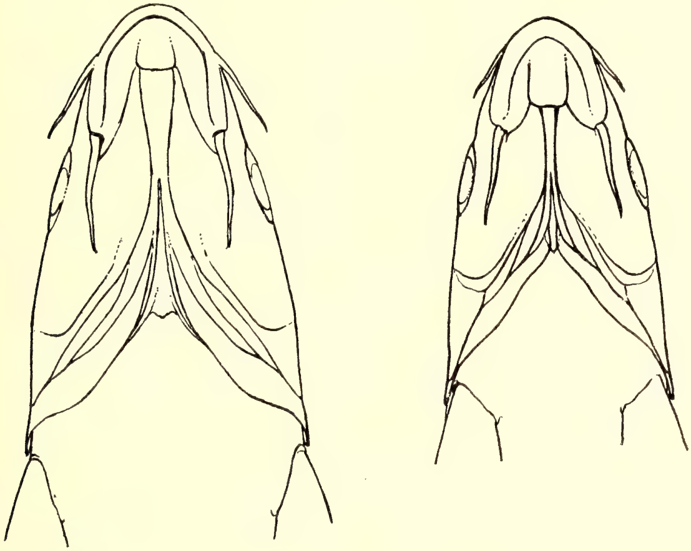
Text-fig. 1.—Lateral view of *Barbus khudree* Sykes. $\times\frac{2}{9}$.

of the head. The diameter of the eye is contained from 2.7 (in the young) to 4.7 (in the adult) times in the length of the head, from 1.0 to 1.4 times in the length of the snout and from 1.0 to 1.7 times in the interorbital distance. The eyes are not visible from below and the interorbital space is almost flat. The lips are fleshy; the lower lip is produced into a median lobe of varying extent. The barbels are, as a rule, shorter than the diameter of the eye, but in half-grown and adult specimens the maxillary barbels may sometimes be as long as the diameter of the eye.

The dorsal fin commences in advance of the ventrals and somewhat nearer to the tip of the snout than to the base of the caudal fin; its last spine is very strong and bony. The length of the dorsal spine is proportionately greater in smaller individuals; it is contained from 1.3 to 1.8 times in the length of the head. The dorsal fin is considerably shorter than the depth of the body below it. The pectoral fin is shorter than the head and is separated from the ventral by a considerable distance. The ventral fin is similar to the pectoral and is provided with a scaly appendage at its base. The anal opening is situated just in front of the anal fin. The caudal peduncle is about one and a half times as long as broad. The caudal fin is deeply forked with both the lobes pointed.

Usually there are 25 scales along the lateral line, but in some young specimens there are 26 or even 27. The number of predorsal scales is 10 and there are 2½ series of large scales between the lateral line and the base of the ventral fin.

The general colour of the spirit specimens is grayish above and silvery below. The scales along the dorsal half of the body are provided with diffuse black markings in their basal portions. In young specimens, up to 45 mm. in total length, there is usually a black spot at the base of the caudal fin.



Text-fig. 2.—Ventral surface of head in two specimens of *Barbus khudree* Sykes, showing variation in the extent of the median lobe of the lower lip. × 1⅕.

Remarks:—In general facies, in the form of the head and lips, and in the nature of the dorsal spine, *Barbus khudree* is similar to *B. putitora*; its body is, however, almost as deep as the length of the head whereas in *B. putitora* the head is considerably longer than the depth of the body. *B. khudree* also resembles *B. progeneius*, but the dorsal spine of the former is very strong and the median lobe of the lower lip is fairly distinct, even in young specimens. It may be noted that so far only a few specimens of *B. progeneius* have been collected and it seems probable that when more material becomes available Sykes' species may prove to be a mere local race of the Assamese *progeneius*.

B. khudree favours strong currents in rivers and in such situations it is fairly common in the headwaters of the Godavari River.

Measurements in millimetres

Total length excluding caudal	362·0	300·0	194·0	129·0	85·0	74·0	34·0
Length of caudal ...	93·0	Damaged	56·0	34·0	23·0	21·0	11·0
Length of head	94·0	81·0	53·0	34·0	23·0	21·0	11·0
Width of head	57·0	46·5	31·0	21·0	13·5	13·0	6·0
Height of head at occiput ...	64·0	52·5	37·0	23·0	16·0	16·0	8·0
Depth of body	97·0	76·5	51·0	36·0	24·0	21·0	10·0
Width of body	60·0	53·0	30·0	20 0	13·5	12·5	5·0
Diameter of eye	20·0	19·0	14·0	9·0	7·0	7·0	4·0
Length of snout	29·0	26·0	18·0	11·0	8·0	7·0	4·0
Interorbital distance ...	34·0	29·0	18·0	11·0	8·0	7·0	4·0
Length of rostral barbel ...	15·0	12·0	9·0	7·0	4·0	4·0	2·0
Length of maxillary barbel.	20·0	17·0	15·0	10 0	5·0	5·0	2·1
Length of dorsal fin ...	73·0	69·0	43·0	31·0	23·0	19·0	9·0
Length of dorsal spine ...	50·0	45 0	37·0	25 0	17·0	15·0	6·0
Length of pectoral ...	71·0	61·0	40·0	25·0	17·0	15·0	6·4
Length of ventral ...	63·0	50·0	34·0	22·0	15·0	13·0	6·0
Length of caudal peduncle ...	61·5	51·0	40·0	25·0	16·0	14·0	6·0
Least height of caudal peduncle	42·0	36·0	23·0	16·0	11·0	9·0	4·0

Barbus kolus Sykes.

(Plate I)

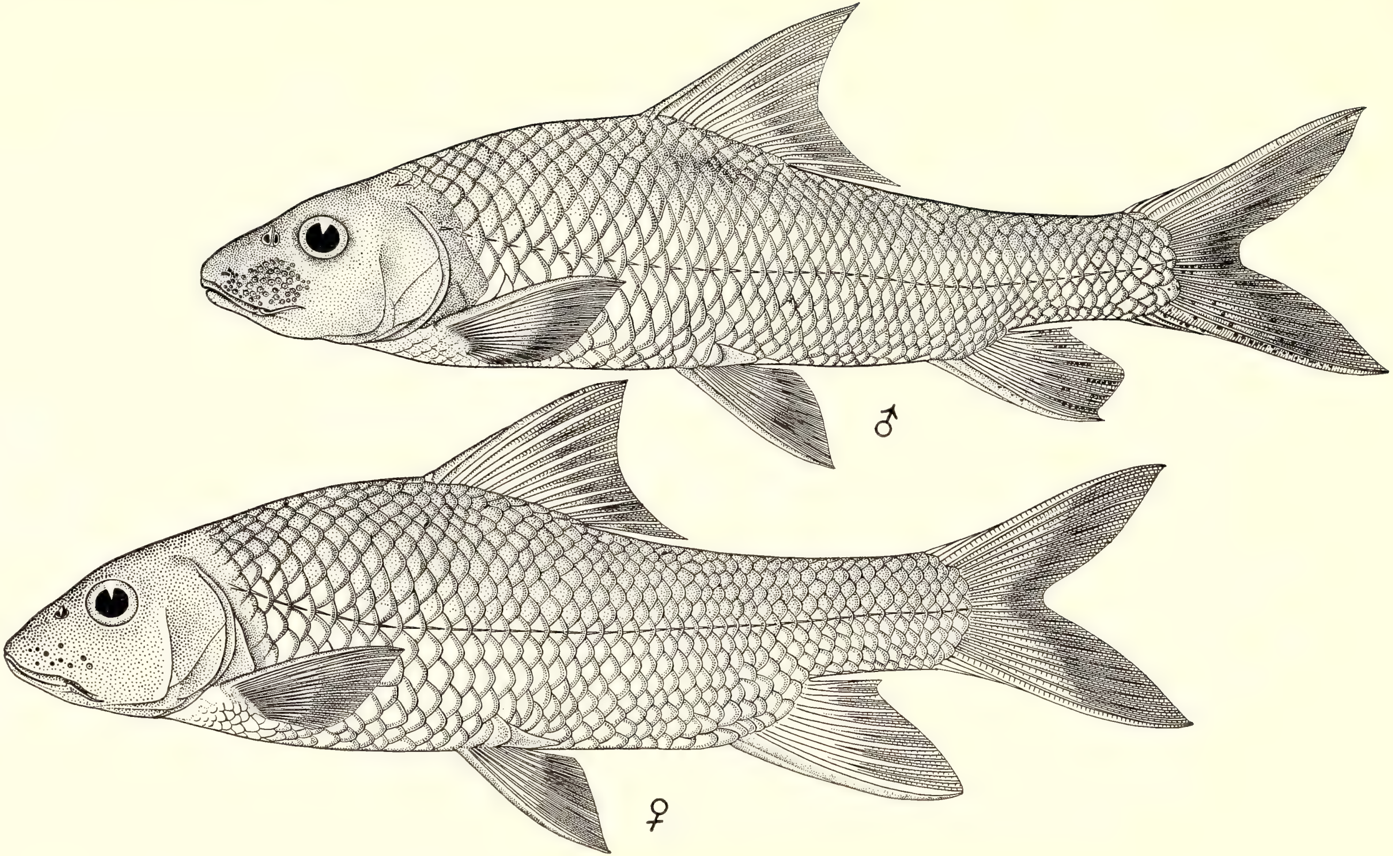
1841. *Barbus kolus,* Sykes, *Trans. Zool. Soc. London,* II, p. 357, pl. lxii, fig. 1.
1868. *Barbus kolus,* Günther, *Cat. Fish Brit. Mus.*, vii, p. 136.
1878. *Barbus kolus,* Day, *Fish. India,* p. 573, pl. cxli, fig. 2.

Barbus kolus is a fairly well known South Indian species. From an examination of a very large number of specimens of this species in Mr. Fraser's collection we found certain characters by which the sexes can be readily distinguished. In the adult males patches of well-developed horny tubercles ('pearl organs') are present on the sides of the snout, on certain rays of the anal fin and in the lower half of the caudal fin. In the case of females only a few small tubercles are sometimes present on the sides of the snout. In the males the body is proportionately less deep and the head longer and more pointed; the dorsal fin is more concave and the outer rays of the anal fin are short so that the median rays form a lobe in the middle of the fin. The secondary sexual differences noted above can be made out clearly from a comparison of the drawings of a male and a female specimens reproduced on plate I.

It may be noted that both Sykes and Günther made a reference to the tubercles on the head, but they were probably absent in Day's specimens, as he makes no mention of them in his descriptions.

Barbus ticto (Hamilton).

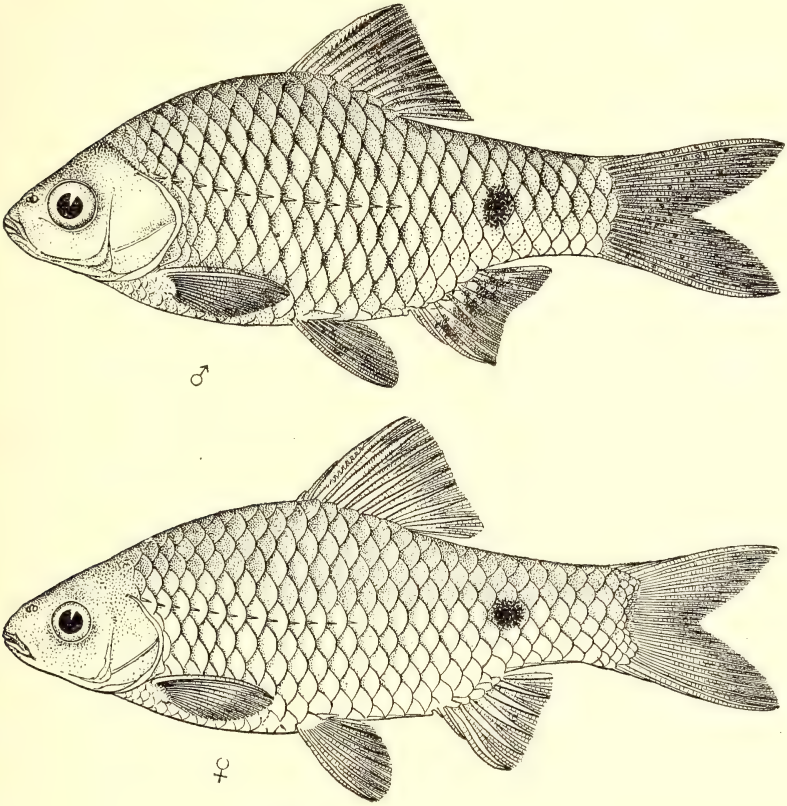
Among the large number of specimens of *Barbus ticto* collected by Mr. Fraser two colour forms could be readily distinguished. In one form the membranes between the rays of the dorsal and the anal fins were intensely black, while in the other these membranes totally lacked this colour. On opening a number of specimens of each



B. Bagchi, *del.*

Barbus kolus Sykes.

kind it was observed that the coloured specimens were males and the plain specimens were females. In the males a number of horny tubercles were present on the caudal fin, while a few of these 'pearl organs' were also present on other fins. Both the colouration and the horny tubercles thus seem to be the secondary sexual characters of the male.



Text-fig. 3.—Lateral view of a male and a female specimen of *Barbus ticto* (Ham.), showing the nature of the secondary sexual characters. × 1 $\frac{3}{5}$

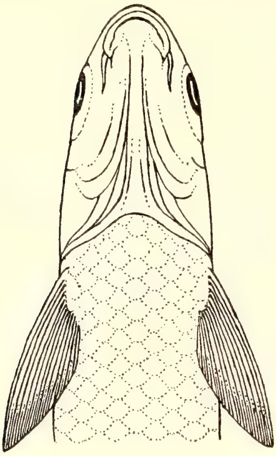
In the Deolali examples the lateral line extends over 10 to 12 scales.

Barbus fraseri sp. nov.

(Plate III, fig. 2).

D. 2/8; A. 3/5; P. 12; V. 8; C. 19; L.l. 42-45.

The new Carp-minnow, which we have great pleasure in associating with the name of Mr. A. G. L. Fraser, is of the *Puntius* type. Its dorsal and ventral profiles are slightly arched and the body is gracefully stream-lined. The head is small and broadly pointed; its length is contained about 5.4 times in the total length and 4 times in the length without the caudal. The width of the head is contained 1.7 times and its height 1.5 times in its length. The eyes are large and lateral; they are situated much nearer the tip of the snout than the posterior margin of the head; the diameter of the eye is contained 3 times in the length of the head, 0.8 times in the length of the snout and 1.2 times in the interorbital distance. The mouth is small, lunate and sub-anterior; it is bordered by fleshy lips which are continuous at the angles of the mouth. The labial groove is widely interrupted in the middle. There are two short maxillary barbels which are less than half the diameter of the eye. Sensory pores are arranged in loops above and below the eyes; they meet posteriorly and are continued into the lateral line which extends over 8 to 10 scales.



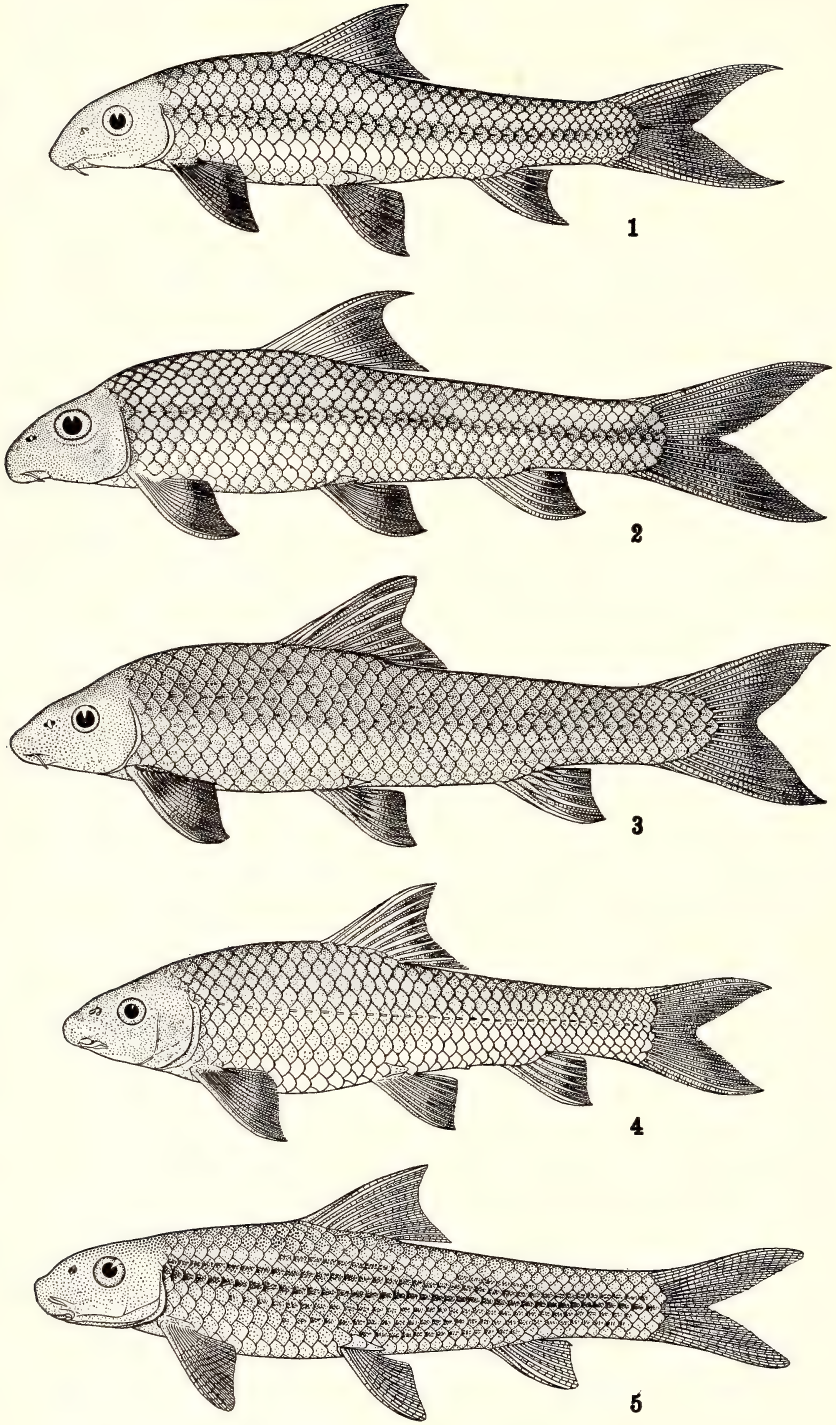
Text-fig. 4.—Ventral surface of head and anterior part of body of *Barbus fraseri* sp. nov. ×4.

The depth of the body is considerably greater than the length of the head; it is contained from 4.3 to 4.4 times in the total length and about 3.2 times in the length without the caudal. The caudal peduncle is narrow; its least height being contained about 1.7 times in its length. The body is covered with small, more or less deciduous scales; there are 42 to 45 scales along the lateral line, 17 series of scales between the bases of the dorsal and ventral fins, 16 round the caudal peduncle and 15 to 16 before the base of the dorsal fin. There is a small scaly appendage at the base of the ventral fin. The anal opening is situated on a prominence close to the commencement of the anal fin.

The dorsal fin commences midway between the tip of the snout and the base of the caudal fin, and almost opposite the commencement of the ventrals; it is almost as long as the head and considerably shorter than the depth of the body below it. The posterior free border of the fin is slightly concave and its last undivided ray is osseous and serrated. The pectoral fin is shorter than the head and is separated from the ventral by a considerable distance; it is about four-fifths of the length of the head. The ventral fin is similar to the pectoral and extends to the commencement of the anal fin. The caudal fin is considerably longer than the head and is deeply forked; both the lobes are sharply pointed.

The colour of the spirit specimens is pale-olivaceous; it is somewhat darker along the dorsal surface. Along the middle of the body there is a silvery streak which becomes wider posteriorly. There is a rounded black spot at the sides of the tail slightly in front of the base of the caudal fin. A somewhat smaller black spot is also present at the base of the anterior rays of the dorsal fin.

PLATE II



B. Bagchi, *del.*

Crossochilus latius (Hamilton) and the allied forms.

Locality :—Darna river, Deolali. Only seven specimens of *Barbus fraseri* were collected at three different points on the river.

Type-specimen :—F 12497/1, *Zoological Survey of India, Indian Museum, Calcutta.*

Remarks :—*Barbus fraseri* can be distinguished readily by the following combination of characters:—

(i) Presence of only two barbels.
(ii) Presence of an osseous, serrated spine.
(iii) Incomplete lateral line.
(iv) Small scales, about 42-45 along the lateral line.
(v) Colouration.

Judged by the above noted characters, our new species seems closely allied to the members of the Malayan genus *Hampala* Bleeker, but differs from it in the extent of the mouth opening, small scales and incomplete lateral line. We are not aware of any other species of the *Puntius*-type which bears any resemblance to the form described above.

Measurements in millimetres.

Total length excluding caudal	34·0	34·0	33·0
Length of caudal	Damaged	12·0	12·0
Length of head	8·5	8·5	8·4
Width of head	5·0	5·0	5·0
Height of head at occiput	7·0	7·0	7·0
Length of snout	2·2	2·5	2·2
Diameter of eye	2·7	2·8	2·7
Interorbital width	3·3	3·4	3·3
Depth of body	10·5	10·4	10·5
Width of body	5·2	5·1	5·1
Length of caudal peduncle	7·5	7·5	7·6
Least height of caudal peduncle	4·5	4·5	4·5
Longest ray of dorsal	8·5	8·5	8·5
Longest ray of anal	4·5	5·0	5·0
Length of pectoral	6·0	6·1	6·1
Length of ventral	7·5	7·6	7·5

Crossochilus latius (Hamilton).

(Plate III)

1934. *Crossochilus latius* (*forma typica*), Mukerji, *Journ. Bom. Nat. Hist. Soc.*, xxxvii, p. 50.

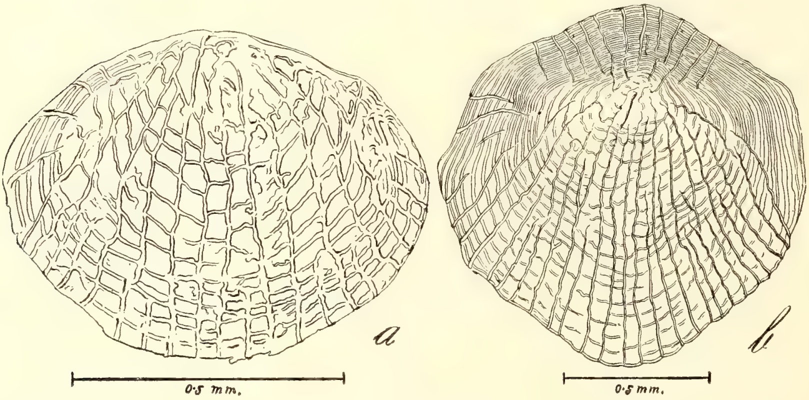
In his detailed work on *Crossochilus latius,* Mukerji observed three distinct types—the typical form from the Brahmaputra river system, the Assamese and Burmese form and the Punjab form. Later work on these fishes from the Eastern Doons, Naga Hills and Kashmir has fully confirmed Mukerji's conclusions. The Punjab and the Burmese forms are now regarded as distinct species—*C. punjabensis* Mukerji and *C. burmanicus* Hora respectively; while the typical form was observed to be limited to the Ganges and the Brahmaputra systems in Northern India. The specimens collected by Mr. Fraser in the Deolali waters are of a considerably smaller size than those found in North India, but morphologically they seem to represent the typical *C. latius*. In the Deccan specimens, however, the eyes are relatively smaller, and in this respect they agree with the Burmese examples. The different species into which *Crossochilus latius* is now divided are figured on plate III.

Parapsilorhynchus prateri sp. nov.

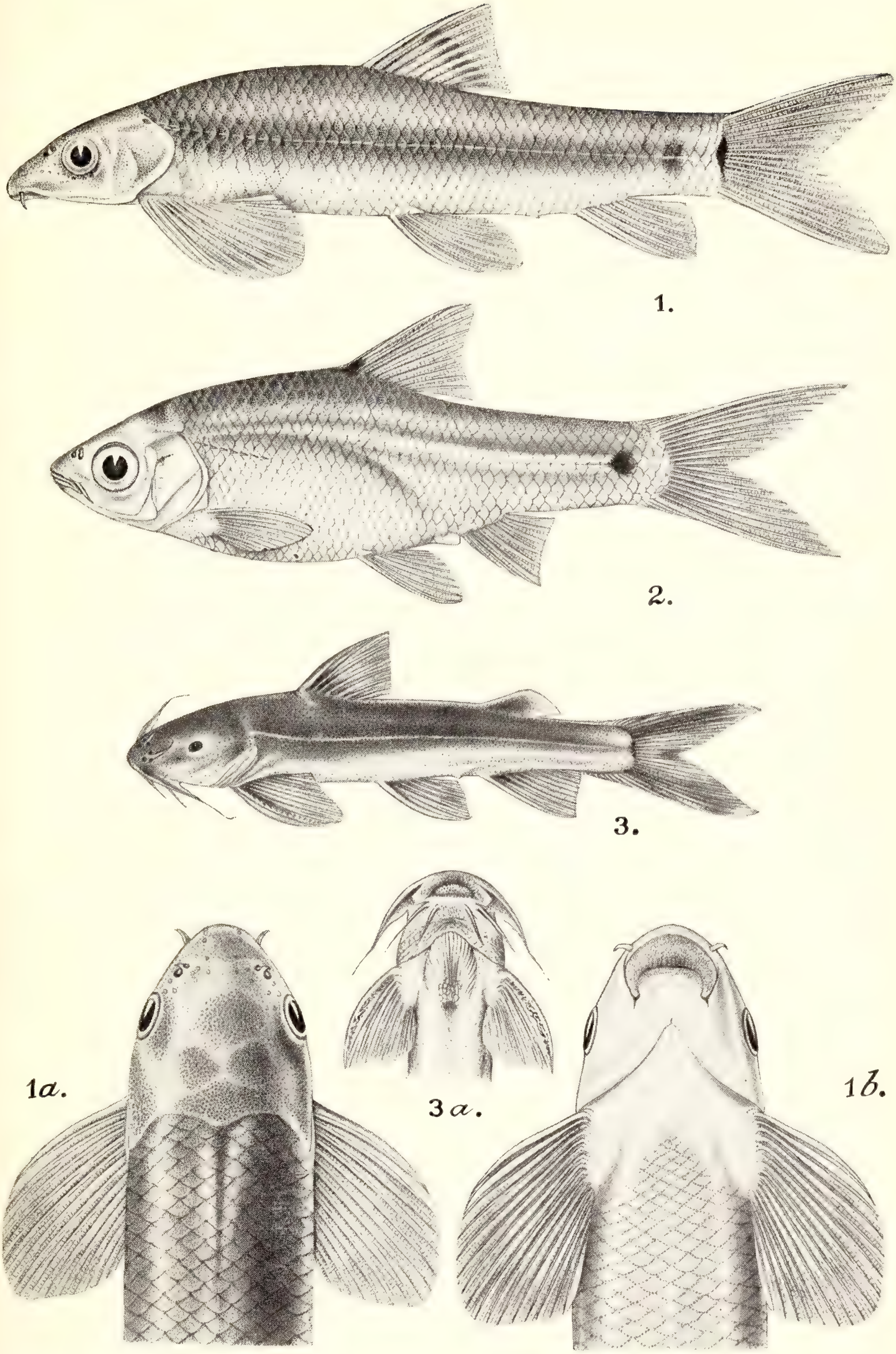
(Plate II, figs. 1, *1a*, *1b*).

D. 2/8; A. 2/5; P. 15; V. 9; C. 19; L.l. 43-47.

In *Parapsilorhynchus prateri,* a small *Garra*-like fish which we have great pleasure in associating with the name of Mr. S. H. Prater, the head and body are considerably depressed and the ventral surface flattened; the dorsal surface is gently arched while the ventral surface is horizontal. The head is broadly pointed anteriorly; it is proportionately longer in young individuals, its length being contained from 4.4 to 5.3 times in the total length and from 3.5 to 4.2 times in the length without the caudal. The width of the head is contained about 1.3 times and its height at occiput 1.6 times in its length. The eyes are fairly prominent and lateral in position; they are visible both from above and below, and are situated almost in the middle of the length of the head. The diameter of the eye is contained from 3.5 to 5 times in the length of the head, from 1.3 to 1.9 times in the length of the snout and from 1.6 to 2.5 times in the interorbital width; the eye is proportionately larger in young individuals. The mouth is small, inferior and horizontal. The upper lip is covered by a prominent rostral fold which is fringed and covered with minute tubercles. The lower



Text-fig. 5.—Scales from below base of dorsal fin of *Parapsilorhynchus* Hora.
a. *Parapsilorhynchus prateri* sp. nov.;
b. *Parapsilorhynchus tentaculatus* (Annandale).



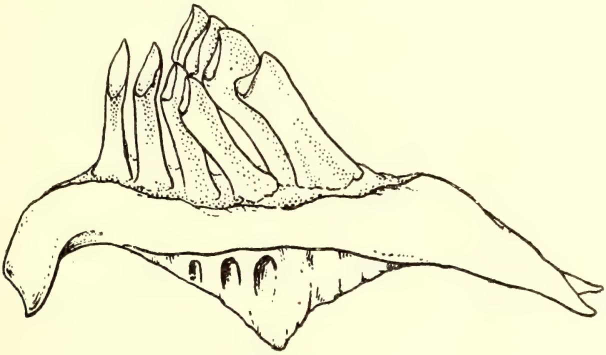
B. Bagchi, *del*.

Fish of Deolali.

lip is also finely papillated. There is a groove round the corners of the mouth which is continued anteriorly round the outer margin of the rostral fold. There are two short and stumpy rostral barbels. The head is provided with a series of sensory pores. Behind the lower lip, which is slightly emarginate, there is a callous area of the skin which presumably helps the fish in adhering to rocks and stones in fast currents and is thus homologous with the post labial disc of *Garra*.

The body is almost as broad as deep; its height is contained from 6.9 to 7.6 times in the total length and from 5.3 to 6.0 times in the length without the caudal. The caudal peduncle is almost as long as or slightly longer than its least height. The scales are small and firmly adherent; there are from 43 to 47 scales along the lateral line, 4½ between the lateral line and the base of the ventral fin, 16 round the caudal peduncle and 21-22 in front of the dorsal fin. The scales are totally absent on the ventral surface between the bases of the pectoral fins and only faintly marked in the area up to the ventral fins.

The scales of *P. prateri* are of a remarkable type; their sculpture consists of a network of radii, all originating from the base and directed distally, and circuli, which enclose small rhomboidal areas. In the allied species *P. tentaculatus* (Annandale) there is a well-defined nucleus from which radii are given both towards the base and to the outer margin. The circuli are not so well developed.



Text-fig. 6.—Pharyngeal bone and teeth of *Parapsilorhynchus prateri*, sp. nov. ×30.

The alimentary canal is greatly convoluted showing that the fish feeds mainly on algal matter which it scrapes off the rocks with the help of its sharp-edged lower jaw. The pharyngeal teeth are sickle-shaped and are distributed in two rows (4.4/4.4). The air-bladder is of the normal Cyprinoid type, but is small and cylindrical. The eggs are of a large size, about 2 mm. in diameter in a fish about 50 mm. in total length.

The dorsal fin commences in advance of the ventrals and is almost midway between the tip of the snout and the base of the caudal fin; sometimes it is slightly nearer to the latter than to the former; its longest ray is almost equal to the depth of the body below it. The paired fins are horizontally placed and fan-shaped; the pectoral fins are almost as long as the head and are separated from the ventrals by a considerable distance. The outer rays of the pectoral fins are provided with adhesive pads on their ventral surface. The ventrals are similar to the pectorals and just extend to the anal opening, which is situated at a distance of one diameter of the eye from the commencement of the anal fin. The anal fin is similar to the dorsal. The caudal fin is deeply forked.

In spirit specimens the colouration is grayish above and pale-olivaceous on the lower half. Along the lateral line there is a broad longitudinal band of a somewhat deeper colour with a lighter band above it. There is a black mark near the upper angle of the gill opening which is partly covered by the gill membrane. A short, narrow, vertical bar is present at base of the caudal fin and another, somewhat broader and more diffuse, in front of it. There is a series of black markings about the middle of the dorsal fin. In some specimens the body is covered with small black spots.

Locality:—Several specimens of *P. prateri* were collected by Mr. Fraser in the North Nallah and Narsullah Wadi.

Type-specimen:—F 12498/1, *Zoological Survey of India, Indian Museum, Calcutta.*

Remarks:—The genus *Parapsilorhynchus* was proposed[1] to accommodate a species discovered by Annandale[2] from small streams in the Poona District and though I described another species in this genus at the same time, the two were afterwards[3] found to be synonymous. *P. prateri* differs from *P. tentaculatus* in having smaller scales and in proportions. There are differences in the scale-sculpture also (text-fig. 5).

In establishing *Parapsilorhynchus* as a distinct genus attention was directed to the features by which it can be distinguished from *Psilorhynchus* McClelland. The features common to both genera are the structures associated with the mouth, such as the rostral fold, grooves round the corners of the mouth, small mouth, sharp lower jaw, etc. A close study of these genera indicates that *Parapsilorhynchus* is less specialised and perhaps an ancestral form. To these two genera must also be added *Gyrinocheilus* Vaillant of Indo-China, Siam and the Malay Archipelago, in which the mouth structures are of the same type.

The occurrence of *Parapsilorhynchus* at Pachmarhi in the Satpura Hills (Hora, *op. cit.*, 1925) shows that the Satpura Mountains may have served at one time as a highway for the migration of the East

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[1] Hora, S. L.—On a New Genus of Fish closely resembling *Psilorhynchus,* McClelland. *Rec. Ind. Mus.,* xxii, pp. 13-17 (1921).

[2] Annandale, N.—The Fauna of certain small streams in the Bombay Presidency. *Rec. Ind. Mus.*, xvi, p. 128 (1919).

[3] Hora, S. L.—On the Fishes of the genus *Parapsilorhynchus* Hora. *Rec. Ind. Mus.* xxvii, p. 457 (1925).

Himalayan forms to the Western Ghats and thence to the hills of the Peninsula.[1]

Measurements in millimetres.

Total length including caudal	59·0	50·0	49·0	49·0
Length of caudal	12·0	11·0	11·0	11·0
Length of head	11·0	10·0	10·0	10·0
Width of head	8·0	7·3	7·2	7·2
Height of head at occiput	6·3	6·0	6·0	6·0
Length of snout	4·0	3·8	3·8	3·8
Diameter of eye	2·5	2·0	2·0	2·0
Interorbital width	5·2	5.0	5·0	5·0
Height of body	8·0	7·0	7·1	7·1
Width of body	7·9	6·9	6·9	6·9
Length of caudal peduncle	6·1	5·0	5·0	5·0
Least height of caudal peduncle	5·3	4·8	4·5	5·0
Longest ray of dorsal	9·0	7·5	7·3	7·3
Longest ray of anal	8·5	5·9	6·0	5·9
Length of pectoral	11·0	9·8	9·6	9·9
Length of ventral	9·2	7·5	7·5	7·5

Lepidocephalichthys guntea (Ham.).

1878. *Lepidocephalichthys guntea,* Day, *Fish. India,* p. 609, pl. clv, fig. 4.

In the case of the Deccan specimens of *Lepidocephalichthys guntea*, Day noted that they possessed only about four rows of spots on the caudal fin and often two rows on the anal fin. In the specimens from the Deolali waters the colour is very variable and there are usually several rows of spots on the caudal fin.

Some of the specimens were greatly compressed and attenuated, and superficially seemed to represent a different species. A careful examination of the material showed that with the exception of better marked scales in the thin individual no other differences could be made out. From Mr. Fraser's labels we found that the thin specimens were those that had lived in an aquarium for a long time. Presumably for want of sufficient food under unnatural conditions they had become attenuated. The scales on the body had become prominent owing to the reduction in the surface area of the body.

Nemachilus botius (Ham.).

1878. *Nemachilus botia,* Day, *Fish. India,* p. 614, pl. clvi, fig. 5.

Day's accounts and figures of *Nemachilus botius, N. aureus,* and *N. sinuatus* show a very close relationship between these species; they are alike in their general facies but differ in the number of rays in the dorsal fin and the relative extent of the lateral line.

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[1] Hora, S. L.—Distribution of Himalayan Fishes and its bearing on certain Palæogeographical problems. *Rec. Ind. Mus.*, xxxix, pp. 255-256 (1937).

Mukerji[1] gave a review of *N. botius* and directed attention to its great variability. We have also noted considerable variation in the number of rays in the dorsal fin and in the extent of the lateral line in the specimens from Deolali, but till good series of specimens become available from different parts of India, Burma and Ceylon it is difficult to discuss its races and varieties.

Nemachilus denisonii Day.

1878. *Nemachilus Denisonii*, Day, *Fish. India*, p. 617, pl. cliii, fig. 5.

The specimens of *Nemachilus denisonii* collected by Mr. Fraser from the Deolali waters are more slender than the examples from the Nilgiris. The colouration of this species is very variable and in the Deolali specimens the caudal fin, instead of being bilobate, is distinctly and deeply forked.

As already noted by Day, we are also of the opinion that *N. notostigma* Bleeker of Ceylon is probably a synonym of *N. denisonii.*

Glyptothorax annandalei Hora.

(Plate III, figs. 3, 3*a*).

1923. *Glyptothorax annandalei,* Hora, *Rec. Ind. Mus.,* xxv, p. 14, pl. i, fig. 3.

In Mr. Fraser's collection there is a single specimen about 65 mm. in total length which we refer to *Glyptothorax annandalei.* It was obtained from the Godavari river and was listed as *G. lonah* in parts I and II of the present series of articles. Recently we obtained some material from the Moola Mutha river near Poona, the type-locality of most of Sykes' species, and doubts arose as to the precise specific limits of *G. lonah.* A more careful examination of the Godavari example and its comparison with the type-series of *G. annandalei* showed that it is presumably a juvenile form of the latter. It possesses an adhesive apparatus on the ventral surface of the pectoral spines, tuberculated body and a series of larger tubercles along the lateral line. The illustrations of the specimen on plate II show some of its salient features.

Glyptothorax annandalei was described from the Bhavani river at the base of the Nilgiris. If our identification of the Godavari example proves to be correct, the species will probably be found to occur all along the Western Ghats.

Ambassis baculis (Hamilton).

1876. *Ambassis baculis,* Day, *Fish. India,* p. 51, pl. xv, fig. 1.

Day gave the distribution of *Ambassis baculis* as: 'Fresh waters of Orissa, Bengal, and as far north as the Punjab : also in Burma.'

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[1] Mukerji, D. D.—Fishes of the Mali Hka River. *Journ. Bom. Nat. Hist. Soc.*, xxxvii, pp. 39-43 (1934).

The record of the species from Deolali is, therefore, of some interest. Though in its deeper body *A. baculis* agrees with *A. nama,* in a great many morphological features it is more closely allied to *A. ranga*. *A. baculis* can be readily distinguished by its smaller scales (about 80 along the lateral line), smaller eyes and the presence of a shoulder spot.

CONCLUDING REMARKS.

In the introduction to the first part of this series one of us undertook to discuss the geographical relationships of the fish fauna of Deolali, with special reference to its affinities with that of the Deccan, but such a course will not be possible now as large collections of freshwater fish have since been received from several localities in the Deccan, and until these are worked out it will not be possible to assess fully the geographical distribution of various species. Particular mention may be made of another collection made by Mr. A. G. L. Fraser at Poona which should enable us to clear the taxonomy of some of the little-known species of Sykes, who in 1841 described a large variety of fishes from Poona and the adjoining areas.

EXPLANATION OF PLATES.

Plate I.

Barbus kolus Sykes.

A mature male and a female specimen of *Barbus kolus* Sykes, showing secondary sexual differences.

Male. × 5/12; Female. × $\frac{1}{2}$

Plate II.

Crossochilus latius (Hamilton) and the allied forms.

Fig. 1.—*Crossochilus burmanicus* Hora from Lower Burma. × $\frac{1}{2}$.
Fig. 2.—*Crossochilus latius* (Ham.) from Manipur, Assam. × $\frac{3}{4}$.
Fig. 3.—*Crossochilus latius* (Ham.) from Dehra Dun, U.P. × $\frac{1}{2}$.
Fig. 4.—*Crossochilus punjabensis* Mukerji from Srinagar, Kashmir. × $\frac{3}{4}$.
Fig. 5.—*Crossochilus latius* (Ham.) from Deolali. × $\frac{3}{4}$.

Plate III.

Fish of Deolali.

Fig. 1.—Lateral view of the type-specimen of *Parapsilorhynchus prateri,* sp. nov. × $2\frac{2}{5}$.

Fig. 1*a*.—Dorsal surface of head and anterior part of body of same. × $3\frac{1}{5}$.

Fig. 1*b*.—Ventral surface of head and anterior part of body of same. × $3\frac{1}{5}$.

Fig. 2.—Lateral view of the type-specimen of *Barbus fraseri*, sp. nov. × 2 $\frac{2}{5}$.

Fig. 3.—Lateral view of a young specimens of *Glyptothorax annandalei* Hora. × 1 $\frac{1}{5}$.

Fig. 3*a*.—Ventral surface of head and anterial part of body of same. × 1 $\frac{1}{5}$.

SOME BIRDS OF A COORG DOWN

BY

F. N. BETTS, M.B.O.U.

(*With 3 plates*).

For ornithological purposes South India may be divided into two definite areas, a Wet and a Dry Zone. The former includes the range of the Western Ghats and a strip of varying width on either side, while the latter comprises all the dry Central plateau, the Eastern plains and part of the Western littoral. Each has its typical avifauna, quite distinct but showing a remarkable parallelism and giving an excellent demonstration of the effect of climate on the differentiation of species.

The boundary line, here at any rate sharply defined, runs right through Coorg, making this little province of peculiar interest to the ornithologist.

The full force of the S.W. Monsoon strikes the Ghats, which rise sheer from the Malabar plain to a height of 5,000-6,000 feet. It sheds much of its moisture on their western slopes but has the strength to carry an ample supply of rain to the rolling plateau which stretches for thirty or forty miles on the other side. It is however finally defeated by the parallel range of low, jungle-clad hills bounding the district on the East. Beyond these the Dry Zone begins.

While on the whole the Dry Zone birds are Low-country and the Wet Zone species Hill forms, rainfall seems to have a much greater effect on distribution than altitude. From the foot of the Ghats almost at sea-level, over the hills, and throughout Coorg proper lying at an average elevation of 3,500 feet, the same species are to be seen, but a mere ten miles through the eastern forest belt and a very slight drop in height brings one into quite a different country.

In the North of the province this strip of jungle is at its narrowest and the chain of hills becomes broken. Here and there patches of country of the Dry Zone type encroach through the barrier and in such spots one finds a very interesting intermingling of the two types of avifauna.

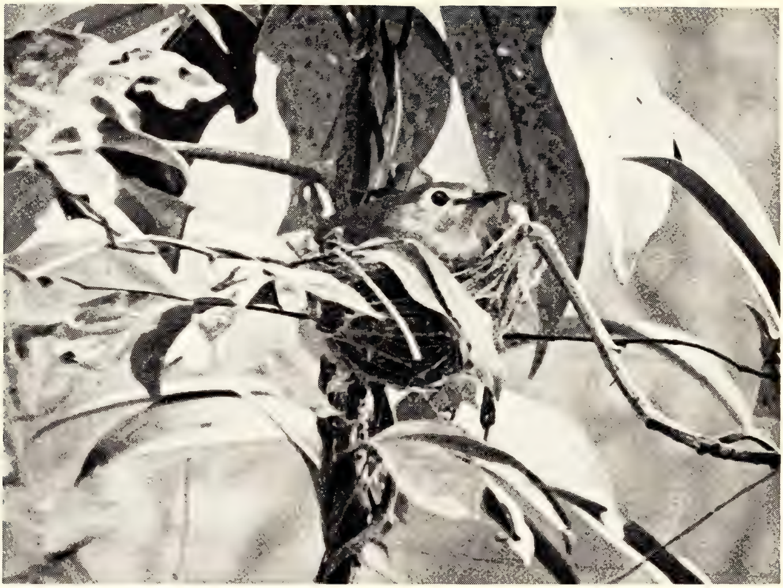
The stretch of downland which forms the subject of this study is one of these. It consists of some three or four hundred acres of grassland and scrub, forming not so much a hilltop as the culmination of a gradual rise of land here reaching 3,750 feet. On the East and South it is bounded by the forest, a growth of mixed deciduous trees and giant bamboo, while on the West and North are paddy fields, village gardens, and coffee plantations under thick evergreen shade. The greater portion is open turf kept short by constant grazing save for frequent tussocks of rushes too tough even for the hungry cattle which roam there. A few solitary wild fig-trees and Indian Laburnums (*Cassia fistula*) grow scattered here and there. All this part is used as a golf course and the high road runs across it, so that, apart from the herd-boys who are always wandering about, it is much frequented. Round the borders and at one end extending over a considerable area there is more cover, clumps of big trees and brakes of lantana, sandal and other scrub growth.

Leaving out of the reckoning most of the birds of prey, swifts and other species, whose daily range is too great to be restricted to such a small tract, an analysis of the representative bird population gives some eighty-five species which occur or have appeared with fair regularity during the last four years. Of these the majority are typical birds of the Coorg countryside and the Wet Zone in general and I do not propose to deal with them here in detail, but sixteen may be classed as Dry Zone forms, eight of them being regular and numerous visitors to the whole of Coorg during the winter, while the remainder, though common enough further east, are seldom seen over the boundary except in a few places such as this.

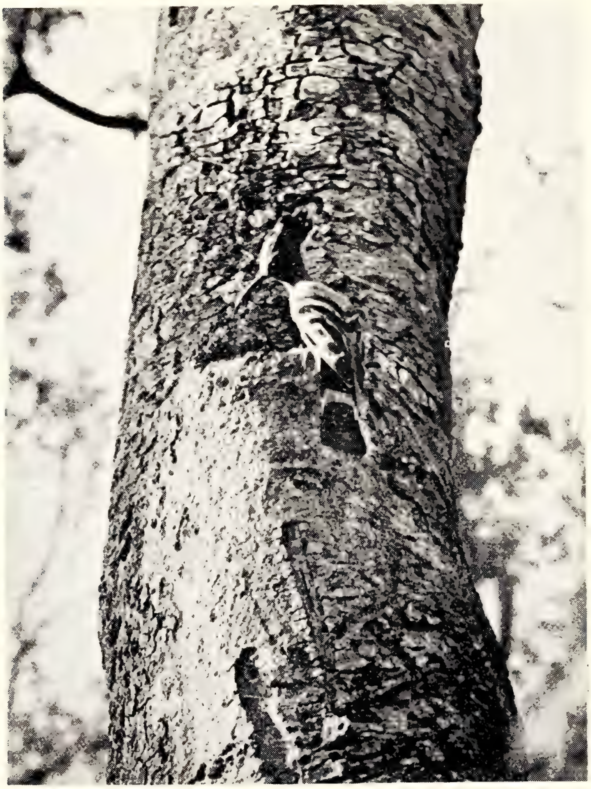
A comparison of the two divisions shows that the Dry Zone types are dominant. I have remarked on the constant parallelism that occurs and, in almost every case, it will be found that the Dry Zone species or sub-species is that typical throughout the greater part of India, while its opposite number is restricted to the S.W. of the Peninsula. Again, whereas it is rare to find any purely Wet Zone species outside its ecological bounds, one of the conspicuous features of the bird life of the borderland is the annual Westerly invasion of Dry Zone birds in the cold weather and their retreat before the arrival of the rains.

While the long-distance winter migrants from the North all arrive and depart within a few weeks of each other, there is no such uniformity in this local movement, and it is evident that a number of different factors affect the wanderings of the various species. Some leave early to breed in the Dry Zone, others stay up to breed and depart when the young are fledged, and one or two only come up for the breeding season and are gone again within a couple of months.

Although very attractive to these visitors, the extent of the down is too small and the monsoon conditions too severe to encourage permanent colonisation. So far as I have been able to ascertain there is only one strictly Dry Zone species, the White-browed Bulbul (*Pycnonotus luteolus*), that has established itself as a permanent resident remaining throughout the year. It is a great place for bulbuls, for within a square mile can be found six of the seven species inhabiting Coorg. As usual the Red-whiskered Bulbul (*Otocompsa jocosa fuscicaudata*) is much the commonest and abounds in the scrub jungle and cultivation and penetrates a short distance into the forest. It is followed, in numbers, by the Red-vented Bulbul (*Molpastes cafer cafer*). It is interesting to note that although the former is decidedly the dominant species over much of the moister parts of South India, it has not nearly such a wide range as *M. cafer* and is unaccountably absent from Ceylon, though it has reached the Andamans and Nicobars. In this



Yellow-browed Bulbul [*Iole icterica* (Strickl.)] on nest.



Hoopoe at nest.

district at any rate the two species are found side by side all over the country in more or less constant proportions though *O. jocosa* is perhaps less numerous in the Dry Zone, and further East, in Mysore, leaves *M. cafer* in sole possession of the field. The latter bird however is nowhere to be found in such numbers as the Red-whiskered Bulbul in its favourite haunts.

The Yellow-browed Bulbul (*Iole icterica*) is a forest species but frequently wanders into the clumps of trees growing among the scrub especially where these have an undergrowth of evergreen-shrubs. It is also to be seen in the coffee plantations and a coffee bush is a favourite nesting site.

The remaining three are much more restricted in their habitat. The Grey-headed Bulbul (*Microtarsus poiocephalus*), is a lover of moist, dark forest preferably near water and is only found in this rather dry country in the belts of evergreens growing in the damp ravines of the few permanent brooks. The Ruby-throated Bulbul (*Pycnonotus gularis*) likewise demands forest, but of a rather lighter order and haunts the borders of these belts where they mingle with the prevailing bamboo. The White-browed Bulbul, on the other hand, is entirely confined to the scrubland with its dense lantana brakes where it loves to lurk, for it is a secretive bird and, until one learns to recognise its loud rattling call, one does not realise how common it is. At least twenty pairs must be resident in the neighbourhood and their numbers seem to be increasing but there is no other colony within miles. They are cut off from their natural biotope by the forest and, though the more open cultivation in the other direction seems not unsuited to their requirements, they do not occur there. This may perhaps be explained by the fact that in this part of the world every mile further West means an increase of several inches in the annual rainfall. They do not appear to move about much. Each pair has its own patch of thicket which they seldom leave, facing out the heaviest bursts of the monsoon, though at such times they are depressed and silent. They undoubtedly breed here but I have not so far been able to find a nest, their retiring habits and the impenetrable nature of their haunts making the search a difficult one.

Another resident which, though not so particular as the White-browed Bulbul and which is really a Dry Zone species, is the Southern Grey-backed Shrike (*Lanius schach caniceps*). Three true shrikes are on the list of Coorg birds, but of these the Bay-backed Shrike (*Lanius vittatus*) is definitely a Plains bird and only just crosses the eastern border. The Grey-backed Shrike, while much more numerous in the Dry Zone, is locally distributed in small numbers all over Coorg where suitable country obtains, being particularly fond of the borders of paddy fields. Wherever found they are strictly sedentary. Ever since I have known the down, two pairs have occupied the same range of a few acres each. For a month or two after they are fledged the young birds of the year hang about but they are all driven off before the cold weather. Though they have harsh voices when annoyed, the male sings very sweetly in the breeding season. The song is low and by no means powerful, uttered in a meditative fashion as if half under the breath and not at all what one would expect from such a bold, aggressive bird. The singer is a remarkable mimic introducing all sorts of other bird and animal noises in a most realistic manner.

By contrast the third species, the Brown Shrike (*Lanius cristatus cristatus*) is a great wanderer breeding in Siberia and visiting us during the cold weather. It is one of the earliest of the long-distance migrants to arrive and quite the last to depart. Most of these visitors are young birds. They are common on the down between October and April and, unlike their resident relatives, are by no means confined to open country but are to be seen just as frequently inside the coffee estates and the edges of the forest. They may sing in their breeding quarters but while with us they chiefly make their presence known by their loud, ill-tempered scoldings.

The allied families of the Wood Shrikes, Cuckoo Shrikes, Minivets and Drongos are all represented among the birds of the down but the residents are Wet Zone types. The Malabar Wood Shrike (*Tephrodornis gularis sylvicola*), is common in the coffee plantations and among the big trees round the borders, whereas the Common Wood Shrike (*T. pondicerianus pondicerianus*) which entirely replaces it in the Dry Zone does not occur. The same applies to the Orange Minivet (*Pericrocotus flammeus*) and the Rosy Minivet (*P. roseus roseus*), while the Little Minivet (*P. peregrinus peregrinus*) is equally at home in either biotope, provided it is fairly well-wooded. The little black and white Pied Shrike (*Hemipus picatus picatus*), more a Minivet than a Shrike in habits, is also not uncommon but does not appear to extend further East.

The Black-headed Cuckoo Shrike (*Lalage sykesii*) is a migrant, arriving in October and departing before the breeding season. They are regular frequenters of the down during the cold weather but I have never seen one there after the middle of April though I have found the nest only ten miles away just beyond the forest belt. The Wet Zone representative of this subfamily, the Large Grey Cuckoo Shrike (*Graucalus javensis macei*) is hardly a resident of the down as it is a great wanderer but it turns up at all times of the year even in the middle of the monsoon. It is perhaps hardly fair to class it as a Wet Zone bird as it occurs in the Dry Zone also. It is really a forest species whose range extends for some way on either side.

The Drongos form a most interesting group. Their characteristic habits make them the most conspicuous of birds and though generally so similar in their ways, the difference in the distribution of the various species is most marked. The two resident forms of the Wet Zone are the Bronzed Drongo (*Chaptia aenea malayensis*), and the magnificent Racket-tailed Drongo (*Dissemurus paradiseus malabaricus*). These are both woodland birds and are common in the coffee bounding the down and frequently wander into the big trees in the scrub. The corresponding resident in the Coorg Dry Zone is the White-bellied Drongo (*Dicrurus coerulescens coerulescens*), which has occurred on the down on one or two occasions in the hot weather as a straggler. It is definitely a bird of rather dry country and low elevations and it is strange that its Ceylon sub-species (*D. coerulescens leucopygialis*) is resident and numerous in the upcountry tea districts at 5,000-6,000 feet where there is an annual rainfall of anything up to 200 inches. The Black Drongo (*D. macrocercus peninsularis*) and the Grey Drongo (*D. longicaudatus*) are probably, with the exception of the Indian Bee-eater, the commonest of our local winter migrants and from October to March are to be seen everywhere. The down with its open spaces and grazing cattle particularly suits their requirements and the telegraph wires running along the main road are a favourite perch. One of the most familiar spectacles of cold weather evenings are King Crows hawking flies from the tree-tops long after all the other diurnal birds have gone to roost. Each has its special perch on the highest point it can find to which it returns again and again after each sally.

There have been sundry notes in the *Journal* on the breeding association of King Crows and Orioles. While the two species do not seem to have much in common in the off season, it is noteworthy that the Indian Oriole (*Oriolus oriolus kundoo*) arrives in Coorg at just about the same time as the Black Drongo. Both species have much the same range in the winter months, leave at the same time and are absent even from the neighbouring portions of the Dry Zone during the monsoon. From the results of the Eastern Ghats survey it seems almost certain that the Orioles migrate to Northern India to breed, but where our King Crows go remains to be discovered. The Drongos appear to be rather given to allying themselves with other birds. In the case of the Racket-tailed Drongo one notices a constant association with the Tree-Pie (*Dendrocitta vagabunda*). This does not however extend to the breeding season, the Drongo wisely disapproving of having that arrant egg-thief as a near neighbour; but at all other times of the year the two are to be found in company and if one is seen the other is sure to be close at hand. What the tie may be is difficult to see unless it is a common hatred of hawks, owls and all birds of prey, for whom they are always on the lookout, and band together to mob and drive away.

Even more numerous in the cold weather than the King Crow is the little Indian Bee-eater (*Merops orientalis orientalis*). They swarm everywhere except in the forest and are particularly numerous on the down. With their bright plumage, pleasant voices, and wonderful mastery of the air, there are few more charming birds. It is a never-failing joy to watch them hunting, darting out from a prominent bough after a passing bee or butterfly, swooping and looping with the utmost grace and agility, almost invariably returning triumphant to their perch to hammer the victim into subjection. They are sociable and affectionate little creatures and vast numbers will roost in company in a favourite clump of trees. As the sun sets the flocks come in from all directions and the last minutes of daylight are spent dust bathing on a sandy road or with much excited twittering performing aerial manœuvres in massed formation above the tree-tops. They are intolerant of cold and on a chilly December morning one may often see a row of green fluffy little balls huddling as tight as they can pack along a bough, loath to stir until the sun has well warmed the world. While the great majority leave at the end of March, one or two pairs stay to breed in Coorg. They have never done so on the down, but I know of at least two spots where solitary pairs have nested for some years in succession. These are apparently just cases of individual idiosyncrasy but may possibly be the forerunners of a more general colonisation as there seems no reason why they should not breed here in large numbers. Even the few that do stay to raise a family leave before the monsoon, and apparently the old birds migrate to some distance as practically all those that one sees in the neighbouring Dry Zone in June and July are juveniles lacking the lengthened, wire-like central tail feathers.

One other species of bee-eater, the Chestnut-headed (*Merops leschenaulti leschenaulti*), is to be seen on the down fairly frequently but their movements are irregular and puzzling. They breed in small colonies along the banks of the larger rivers all through Coorg and for the rest of the year seem to wander casually in small flocks, lingering in one spot for a few days and then passing on. They may turn up at any time even during the height of a monsoon burst and the weather seems to have little effect on them.

Most of the birds hitherto mentioned occur all over Coorg during the cold weather, but the remainder of the Dry Zone visitors to the down will seldom be seen elsewhere outside their native territory.

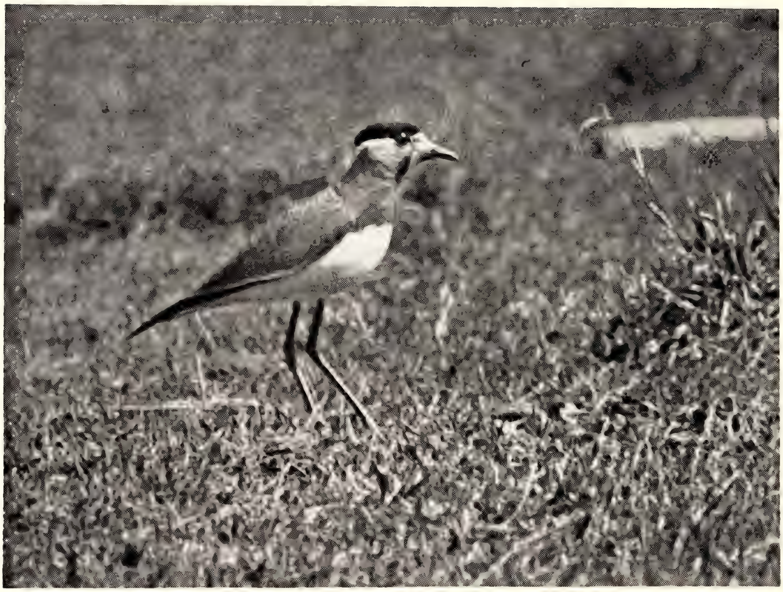
Certain birds have become almost parasitic on Mankind, and as the wilderness is opened up and developed extend into regions where they have hitherto been unable to penetrate. The House Crow is a typical example, although it is perhaps out of place to bring it into this paper as it does not occur within the limits under consideration. It is by nature a bird of the plains but has gained a precarious footing in Coorg, a few pairs inhabiting three of the only four towns of any size of which the province can boast. Even here, they are far outnumbered by the Jungle Crows and appear to exist very much upon sufferance never venturing beyond the built-up areas. The status of the Common Mynah (*Acridotheres tristis tristis*) is rather similar, but it has so far only reached the confines of the Wet Zone and I have not come across it anywhere except on the down. Unlike the Crows however, they seem in perfect amity with their near relatives the Jungle Mynahs (*Aethiopsar fuscus mahrattensis*), which are the prevailing species. Nearly always during the winter one can pick out one or two common mynahs among the small parties of jungle mynahs that attend the grazing cattle or spend their evenings chattering on one of the lone trees scattered about the down, and both join with the little Grey-headed Mynahs in the big, cold weather roosting assemblies. Although our birds linger on into the hot weather and pair off when the Jungle Mynahs start breeding, I do not think they nest with us and they are certainly absent in the monsoon. The Common Mynah is slightly larger and heavier than its cousin and would presumably be the winner if it came to blows, so that one can only presume that their scarcity is a question of climate. It is really rather strange that they should be found at all as they are very much birds of open cultivation and the few that do occur must have followed the carts up the Ghat road running through the wide stretch of uninhabited country cutting them off from their normal habitat. Even in the Dry Zone they leave the jungles to the Jungle Mynah and the Brahminy Mynah (*Temenuchus pagodarum*). One would rather have expected to see the latter bird which swarms just over the border and is very partial to the type of light jungle found on the down but to my knowledge they never penetrate through the forest belt.

Another bird which finds it furthest limit on the down is the Coppersmith (*Xantholaema haemacephala indica*). The Malabar Coppersmith (*X. rubricapilla malabarica*) with its relation the Small Green Barbet (*Thereiceryx viridis*) must be the commonest birds over a great portion of Coorg, their only possible rival being the Red-whiskered Bulbul. They are especially numerous in the coffee estates where wild fig trees grown as shade afford limitless food supplies and nesting sites, and their monotonous calls are the most characteristic bird sounds of the countryside. They abound in the plantations and the trees round the edge of the down but do not extend far into the forest on the East. Here they encounter the true Coppersmith which can be recognised at a distance by the duller green of its plumage and close at hand by the yellow which replaces much of the crimson markings on face and throat. This is the species found in the Dry Zone. It occurs in small numbers through the forest wherever there is a fair stand of trees among the bamboos, while except during the monsoon one or two are usually to be seen on the down. The two species do not intermix and the visitors have a furtive and subdued air as though they realised that they were in unfriendly country. They carefully avoid the strongholds of their rivals and confine themselves to the scattered trees out in the middle of the grassland or to those on its immediate edge. They are usually solitary and I have never heard them calling and do not think that it is likely that they breed here. Probably like so many frugivorous birds they wander a great deal according to the supply of their favourite food

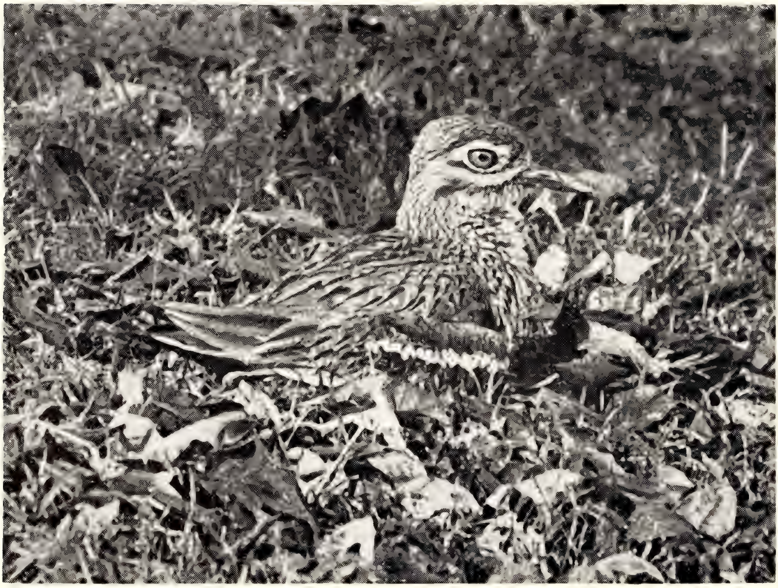
This is certainly the case with the Southern Green Pigeon (*Crocopus phoenicopterus chlorogaster*) which, though common in the Dry Zone, is only a very rare visitor to the down in years when there is a particularly good crop of wild figs. The Pompadour Green Pigeon is much more numerous and almost any fig tree in fruit is sure to be attended by them, but except at these feeding places they are rarely seen and I have yet to discover their breeding haunts. All the Green Pigons of course are adept at concealing themselves. There may be fifty in a tree but until one takes wing, their presence will often be quite unsuspected.

The two remaining, non-breeding Dry Zone visitors which have occurred on the down are the Indian Roller (*Coracias benghalensis* *indica*), and the Green-billed Malkoha (*Rhopodytes viridirostris*). Both appear to be mere strays. In some years none are seen but usually one or two turn up at any time between January and April and may linger about for several weeks or be gone in a day or two. There is no missing the presence of the rollers for they keep to the open and choose the most conspicuous perches, their favourites being the telegraph wires or the solitary Indian Laburnum trees which are leafless at that time of the year and, when they swoop down to catch the grasshoppers on which they largely feed, the beautiful blue of their wings is visible at a great distance. The Malkoha, on the other hand, is a skulker and is to be looked for among the scrub. It is decidedly shy and if aware that it is being watched disappears into the heart of the nearest thick tree. It clambers actively among the branches, rarely coming to the ground and is a poor flier seldom going any distance on the wing. At long range it looks not unlike a small male koel but the white tips to the graduated tail feathers are a good distinguishing mark. It is an extremely silent bird and I have never heard one utter a sound.

I have found four species which must definitely be classed as migrants breeding on or round the down. The Hoopoe is with us for the greater part of the year arriving in September and only leaving at the onset of the rains. Its favourite haunt is parkland where large trees grow plentifully but widely spaced on short sward. The latter is essential as they are entirely ground feeders, and dense undergrowth or even long grass is of no use to them. One or two pairs breed regularly in the neighbourhood, finding the down with its expanses of turf and big trees full of nesting holes much to their taste. They start early, usually at the beginning of February, well before the Mynahs are thinking of domestic affairs. Perhaps this is intentional as by the beginning of April, the latter have annexed every suitable hole and would think nothing of evicting their less sturdy neighbours. It always comes as a painful surprise that such a dainty and elegant bird as the Hoopoe should be so insanitary in its domestic arrangements. One has only to put one's nose near one of their nesting holes to identify the owner. Perhaps for this reason, in the case of the one or two pairs with which I have been intimately acquainted, the same site has never been occupied two years running, though they were undisturbed and the holes were vacant. They are devoted parents and, though I have been unable to discover whether the male takes his turn at incubation, he is indefatigable in feeding his mate while she is on the nest, and when the young hatch both are hard at work all day long. They seem to give themselves a lot of unnecessary labour. I watched one for the best part of an hour one morning in which time he made half a dozen trips to the same spot a good quarter of a mile away uphill. Grasshoppers and ants appeared to be his quarry and on examination of the ground they seemed to be no more numerous where he was searching than in an exactly similar locality within a hundred yards of the nest. I have several times had the luck to witness their courtship. The female in each case was the more ardent wooer.



Yellow-wattled Lapwing [*Lobipluvia malabarica* (Bodd.)].



Photos by author.

Indian Stone Curlew [*Burhinus oedicnemus indicus* (Salvadori)].

She flies up to her mate often with an offering of food, cuddles up to him with low croaks and fully expanded crest, then crouches with quivering wings inviting an embrace. Apparently coition goes on much longer than one would expect, for on one occasion I saw the hen fly out from a nest containing eggs at least ten days incubated and successfully solicit her mate who had arrived with food. This particular male used to roost in the crook of a low tree just outside my garden some hundreds of yards from the nest. He would appear every day just after sundown and nestle into the cup formed by the two main branches where his dusty feet soon left a permanent mark.

The Indian Stone Curlew (*Burhinus oedicnemus indicus*) appears every hot weather. During the first few months of the year they may often be heard calling overhead at night but I have only once found them breeding here. This was in the scrubland bordering on the golf course. The two eggs lay in a slight scrape among the dead leaves under a small isolated thorn tree which gave little shade. As might be expected with such a crepuscular species, the bird when sitting found the heat and glare very trying, spending most of the time panting with open beak and half-closed eyes. There were plenty of spots in the neighbourhood apparently just as suitable and well-shaded in the heat of the day and I cannot imagine why one of these was not chosen. The male kept close to his mate while she was on the nest and both birds were extremely wary, slipping off into the jungle on the least alarm. They did not prove difficult photographic subjects however. There was a convenient clump of bushes close at hand in which the hide was concealed and as soon as the helper was gone, the hen returned, announcing her arrival by a short croak, the only sound I ever heard them utter near the nest. I knew the cock was close by, but unfortunately he would never come into the picture.

Last year there was a most unexpected visitation in the shape of a pair of Yellow-wattled Lapwings (*Lobipluvia malabarica*), the only members of this species that I have seen in Coorg or indeed within twenty miles of its boundaries. They arrived in February and by the end of the month had a nest with two eggs right out in the open on the edge of one of the fairways. This for some reason was deserted, possibly because the spot was undermined by white ants, and the birds disappeared for over a fortnight. They returned however and four more eggs were laid on a scanty saucer of small bits of dried cowdung and the brood successfully reared. It was rather surprising that they were able to do this as the spot is much frequented, cover nil, and the birds themselves not small, though the greenish brown of the upper plumage blended so admirably with the burnt-up turf that the hen while sitting was invisible at any distance. I was most anxious to get some photographs but in such a populous situation it was impossible to make any elaborate hide without attracting unwelcome attention. The best I could do was to leave a pile of leafy boughs near the nest late one evening and come back at dawn next day to construct a rough tent of sacking under the heap. I was pleased to see the bird make off at our approach and with all speed I got into hiding and sent off my helper. Both birds soon came into view. One, which I took to be the cock, ran up to the nest, seized a piece of cowdung lying beside it and went off. Shortly after his mate returned and settled down. Until the sun was well up she was restless but as soon as it got hot she sat closely though she evidently felt the heat as she panted distressfully. To me one of the most puzzling problems of nature is how these ground-nesting birds in the Tropics can survive, sitting all day in the blazing sun-shine often on sand or shingle literally burning to the touch, where the eggs if left uncovered become baked in a few minutes. It was interesting to note her reactions to possible enemies. A human being would send her flying straight off the eggs to a safe distance where, if unnoticed, she would stand until the coast was clear. If however she thought she was watched, both she and her mate would fly right away out of sight as if they had been disturbed from a casual feeding ground. Grazing cattle she cared little for, only moving and that reluctantly if she appeared in danger of being trampled. When a hawk or crow passed overhead she crouched flat, head and neck laid along the ground.

As soon as the young were hatched both parents became highly demonstrative, flapping wildly round any intruder on their domain, calling angrily. The chicks were full-grown by the end of May and the whole family thereupon departed and were seen no more until the following January when a solitary bird turned up in the same place. Within a week its mate had arrived and a nest was made almost on the site of the previous one. I was much surprised to find that the eggs were entirely unlike the previous ones, being an erythristic type with a pinkish ground colour. Presumably the original hen must have met with disaster and the cock had taken a new wife. In view of Stewart Baker's notes on this species in the *Nidification of Birds of the Indian Empire,* it seems likely that she must have come from the laterite belt on the West Coast perhaps seventy miles away as a bird flies, where apparently this coloured egg is the rule. Here they were decidedly conspicuous on the brown grass and were soon robbed. On this occasion no second attempt was made and the down has since been deserted.

The last of our Dry Zone visitors, the Koel makes the shortest stay of any. They seldom stray far over the boundary and the down about marks their limit. Although I have not had conclusive proof that they breed here there is strong presumptive evidence. They arrive towards the end of March when the Crows are starting nesting operations, and for a few weeks make themselves very conspicuous. They are extremely noisy and there appears to be much competition among the males which predominate in numbers for possession of a mate. They always seem in a desperate hurry and dash from tree to tree as though the devil himself was after them. The Crows have no love for them and chase them whenever they encounter them. By the end of April they disappear, their hosts having hatched off their families, and opportunities of cuckolding no longer remaining.

Nesting ground of Stone Curlew.

Photos by author.

The golf course—nesting ground of the Yellow-wattled Lapwing.

SOME NOTES ON BUTTERFLIES AND BIG GAME IN KASHMIR.

BY

COL. W. M. LOGAN HOME.

(*With two plates*).

Although I first started butterfly collecting in Kashmir in 1909, I realised, on the eve of my retirement in 1934, that there were still many fairly common Kashmir species which I had not yet added to my collection.

The principal cause of this had been the lack of available information regarding definite localities for the less common species. With, perhaps, the exception of Bingham's, most works on Lepidoptera give only large districts for the various species; such as: 'Kashmir to Kamaon'; Chitral to Ladakh, etc.

Such information is not definite enough for a collector who has only a month or two of leave; and the following notes are written in the hope that they may be of some benefit to fellow collectors who have been similarly handicapped.

It is not claimed that the lists of butterflies are complete; they simply give those actually seen by the writer.

Having secured 8½ months' leave pending retirement, I set about making preparations for a combined butterfly collecting, and big game shooting expedition, in Kashmir in 1934. I arrived at Rawalpindi in March; and motored up to Srinagar in perfect weather.

En route it was interesting to note, at this early date, *Papilio polyctor* and *machaon* in fresh condition at about 2,800 feet, between Kohala and Domel, and further up, *Pieris daplidice moorei* and *Colias croceus edusina*, flying over the short grass at the road side between Baramulla and Srinagar.

On arrival at Srinagar I spent some days making the usual arrangements for Kashmir travel, and during this time I also investigated the foothills round the Dhall Lake.

There was a great hatch out of *Colias c. edusina* here, and a few *Colias hyale, Pieris d. moorei, Papilio machaon, Lycaena phloeas, Strymon sassanides* were also noticed. The only uncommon species I took was a single *Euchloe ausonia daphalis*, on a low ridge to the east of the Nishat Bagh.

I left Srinagar at the beginning of April, and spent a few days in the Sind Valley trying to bag a Serow, without success. Butterflies I saw there, were *Argynnis lathonia issoea, Vanessa canace himalaya, V. cashmirensis* and a few *Pieris rapae* and *Polyommatus eros*. Before leaving Srinagar I had registered my name at the Game Office for Moji nullah, one of the best districts for Markhor; but at that time two other sportsmen had their names down for it before mine. About the middle of April I left the Serow ground and moved down to Sopor. Here I learnt that the two sportsmen already referred to had relinquished their claim, and accordingly I marched to the Kajnag and crossed into Moji from the Jhelum Valley.

On the way up the nullah *Papilio polyctor* were plentiful, besides *P. machaon, Pararge schakra* etc., and I found *Everes diporides* alongside the track at 3,000 feet, and secured a nice series.

At the top of the pass into Moji, at about 9,000 ft. a few *Parnassius hardwickei* and *Pieris callidice kallora* were flying about, with the usual *Argynnis lathonia* and *Vanessa cashmirensis.*

The next two months were spent in the strenuous business of trying to bag a good Markhor. In this I was unsuccessful, and I was greatly disappointed at the scarcity of Markhor in this nullah. Poachers were all over the place when I first entered the nullah, shots being fired nearly every day; and the third day I was there I sighted through my glasses 2 men with slung rifles moving across a snowy ridge on the S.W. side of the nullah. The Game Watcher was not to be found, and in fact never put in an appearance till the day I was leaving, when all he did was to ask me the number of my license; truly adding insult to injury!

A significant point is that I saw no young kids of the year with any of the few does I saw, and it might not be out of place here to wonder whether any members of the Society have been shooting in the Kajnag since that year (1934), and if so whether they can give any information on the position of Markhor there?

In the butterfly line I was unlucky too, I missed the only *Vanessa urticae rizana* I saw. Other species seen in Moji were:—

Papilio machaon asiatica C. April-June, 8-10,000 ft.
Papilio arcturus arius R. June, 7,000 ft.
Parnassius hardwickei R. a few seen on 15th April at 9,000 ft. afterwards one only in May, 8,000 ft.
Pieris callidice kallora R. a few seen on April 15th at 9,000.
Pieris napi ajaka V.C. May-June, 7,000.
Pieris canidia indica V.C. May-June, 7,000.
Pieris brassicæ C. May-June, 7,000.
Pieris rapæ N.R. May-June, 7,000.
Belenois mesentina R. 2 only seen, 11,000 ft.
Gonepteryx rhamni nepalensis V.C. May-June, 6-7,000 ft.
Gonepteryx aspasia zaneka C. May-June 8-9,000 ft.
Colias croceus edusina V.C. May-June, 8,-9,000 ft.
Pararge schakra N.R. May-June, 6-8,000 ft.
Aulocera padma padma R. 1 only at 8,000 ft., May-June.
Neptis s. sankara R. One only at 8,000 ft., May-June.
Vanessa cardui V.C. 6-9,000 ft., May-June.
Vanessa egea kashmira C. (Spring form) 7-8,000 ft., May-June.
Vanessa urticæ rizana R. 1 only at 9,000, May-June.
Vanessa c. cashmirensis V.C. 6-9,000 ft., May-June.
Vanessa xanthomela fervescens C. 8-9,000 ft., May-June.
Argynnis childreni sakontala C. 8-9,000 ft., May-June.
Argynnis kamala C. 8-9,000 ft., May-June.
Argynnis lathonia issoea V.C. 8-9,000 ft. May-June.
Argynnis jerdoni jerdoni N.R. Very local, large number noticed flying about on small grass slope at about 10,000 ft. on 25th May.
Melitea arcesia balbita R. 1 only at 8,000 in May.
Libythea l. lepita N.R. 6,000, May-June.
Polyommatus eros N.R. 7,000, May-June.

Ibex ground, Bisal nullah, September. Steep slopes haunted by:—*Parnassius jacquemontii* R; *P. epaphus nirius* C; *Aulocera swaha gilgitica*; *Arginnis aglaia vitatha* R; *A. pales korla* R; *Polyommatus epiron jermyni* R; *P. eros janetae*; *P. omphisa*.

The Satpa la, 14,500 ft., July. Rocks on the right haunted by:—*Parnassius charltonius* R; *P. delphius nicevillei*, R; *P. epaphus nirius* C.

Lycæna phloeas indica V.C. 7-8,000 ft., May-June.
Heliophorus bakeri N.R. glades in pinewoods 7-8,000 ft.
Heliophorus androcles coruscans R. 2 only seen, 7-8,000 ft.
Rapala micans selira N.R. May-June at 7,000 ft.
Hesperia alpina C. May-June at 7,000 ft.
Carcharodus altheæ dravira R. 2 only, 8,000, May.
Baoris discreta himalaya R. 1 only, 8,000 ft., May.

The *Argynnis* and *Vanessa* were very fond of both primulas and viburnum. Early in June I gave up all hope of getting a good Markhor; the jungle was very thick and I only kept on seeing the same animals; so I struck camp and marched back to Srinagar.

I already had my name down for an Ovis Ammon block in S.E. Ladakh, and after laying in a stock of fresh supplies, I set out once more to the Sind Valley.

There were very few butterflies to be seen until I had crossed the Zoji La, but on the north side of the Pass *Pieris callidice kallora* were plentiful and near Dras I secured some *Colias hyale* var: *erate* and a good series of *Polyommatus vicrama cashmirensis.* Neither of these had I seen before.

Near Kharbu I noticed a solitary *Polyommatus omphisa* sitting on some wet sand on the path, and I secured some *Pararge menava menava.* The march from Kharbu to Kargil is a hot one in the summer, though the scenery is very fine, the track winding through rugged mountains, with here and there a distant snow peak; while alongside the track are numerous rose bushes in full bloom. I was glad enough however, to reach the comparative coolness of Kargil's green fields and apricot groves.

Near Kargil I met a sportsman who had been in the district of Ladakh for which I was bound, and he told me he had seen only small male ammon and herds of does there. This was disconcerting news, and after discussing matters with my Shikari, I decided to alter my plans and make for the glacier country at the top of the Shigar Valley in Baltistan. This district was well known to my Shikari; he had been with several sportsmen who had secured good Ibex there, and I considered that there was also a chance of my coming across some uncommon butterflies.

Accordingly after a halt in Kargil, I retraced my steps, and finally arrived at the Satpura nullah, south of Skardu, early in July. Near the village of Kirkitchoo I caught a single specimen of the rare *Polyommatus devanica devanica.* The top of this nullah holds a variety of butterflies, and I spent some interesting days there.

No less than 5 species of *Parnassius* occur in the Satpura, 4 of them flying together on the same ground at 13,000 ft. In this connection an interesting point is that *Parnassius hardwickei* is replaced on the same ground at a later date by *Parnassius epaphus nirius.*

My first visit to the Satpa La was on 18th July and *hardwickei* were abundant then, but I only saw 1 *P. e. nirius.*

When I crossed the Pass on 12th September *P. e. nirius* were swarming, but not a *hardwickei* was to be seen.

It would appear that *hardwickei* passes the winter in the pupa stage, and hatches out soon after the snow has left its haunts; whereas *nirius* passes the winter in the egg stage, the larva hatches out in the early summer and pupates, the imago appearing in the autumn. I saw a fair number of *P. delphius nicevillei*, but only 3 *jacquemonti* and 1 *chaltonius*. The latter were flying about among precipitous rocks much higher up than the other 4 *Parnassius*, at about 15,000 ft. and I had no time to go after them.

About the 12th August ♀♀ *charltonius* were observed to be laying their eggs on the large pieces of slaty rock which were strewn about the base of a cliff, round which they were continuously flying.

List of butterflies met with round Skardu.

Parnassius jacquemonti R. 13,000 ft., July-September.
Parnassius epaphus nirius C. 13,000 ft., August-September.
Parnassius delphius nicevillei R. 13,000 ft., July.
Parnassius hardwickei C. July.
Parnassius charltonius R. 13-15,000 ft., July-August.
Top of Satpur Nullah
Pieris brassicæ C. 7,700 ft., July-September, Skardu.
Pieris rapæ C. 7,700 ft., July-September, Skardu.
Pieris callidice kallora C. 13,000 ft., July, Satpura.
Colias hyale C. 7,7000 ft., July, Skardu.
Colias croceus edusina C. 7.700 ft., July, Skardu.
Aporia leucodice soracta R. 10,000 ft., July, Satpura.
Pararge menava N.R. 7,700 ft., July, Skardu.
Maniola lupinus kashmirensis N.R. 7,000 ft., July, Skardu.
Maniola pulchella N.R. 11,000 ft., September, Satpura.
Karanasa h. hubneri R. 12-13,00 ft., September, Satpura.
Argynnis adippe jainadeva R. 11,000 ft., July, Satpura.
Eumenis parisatis parsis C. 7,700 ft., July, Skardu.
Everes argiades Indica N.R. 7,700 ft., July, Skardu.
Polyommatus vicrama cashmirensis N.R. 7,700 ft., July, Skardu.
Polyommatus christophi samudra N.R. 7,700 ft., July, Skardu.
Polyommatus astrarche N.R. 7,700 ft., July, Skardu.
Polyommatus orbitulus R. 14,000 ft., September, Satpura.
Polyommatus eros janetæ N.R. July, 7,700 ft., Skardu.
Hesperia alpina N.R. 11-12,000 ft., July-September, Satpura.

Owing to a sudden rise of the Indus, I was delayed 4 days in my start for the Shigar Valley, as the ferrymen reported the crossing to be unsafe. By the time they considered the water had fallen sufficiently, a large number of would-be passengers had collected, including cows and ponies, all of which were safely ferried over. A hot march of 16 miles brings one to Shigar, and thence another 60 odd miles to Arundu. Between Shigar and Arundu I saw the following:

Colias c. edusina V.C.
Colias hyale V.C.
Eumenis parisatis parsis C.
Pararge menava N.R. in rocky ground.
Aulocera swaha swaha R. near Chetrun.
Vanessa xanthomela fervescens N.R. round Arundu.
Vanessa cardui R.A. few near Arundu.
Strymon sassanides N.R. above Chetrun.
Polyommatus eros C.
Polyommatus christophi samudra N.R.

3 miles below Arundu I caught a few of the rare *Polyommatus astorica* flying among a small aromatic shrub.

In the Chogolungma, August. Meadow in foreground haunted by:—*Colias eogene francesca, Karanasa hubneri, Polyommatus eros janetae, P. omphisa, P. orbitulus, Lycaena kasyapa, Hesperia alpina* and rocks in background by:—*Parnassius delphius chitralica.*

In the Kerolungma, August. Grassy slopes haunted by:—*Colias e. francesca, Erebia mani,* R. *Maniola pulchella, M. d. brevistigma,* R. *Polyommatus omphisa, P. eros janetae, P. epiron jermyni,* R.

On 29th July I pitched my base camp in a pleasant willow grove above Arundu village, with a view to the south and east of range on range of snow-capped mountains.

A couple of hundred yards away was the snout of the Chogolungma Glacier, a black wall of ice, from the base of which gushed out the dirty snow-fed waters of the river; and I spent some time next morning examining this, as our route was to lead over the Glacier near this point.

My Shikari having secured a guide and 8 coolies, we set forth on 31st July with a couple of light tents, and food for 10 days.

A rough track, made by half-bred Yaks, led over the Glacier, and we followed this for 2 miles before reaching the left bank. The villagers drive their Yaks onto the Glacier when the snow has melted sufficiently and the beasts find their way across and up into the flowery meadows beyond.

Camp was pitched about 2 o'clock among some willow bushes, and very soon after a snow storm came on, and blotted out the landscape for the rest of the day.

The next day the Shikari went off very early to look for Ibex, while I spent a profitable morning after butterflies on a grassy hillside near camp. I was very pleased at securing a fine series of the uncommon *Lycaena thetis aditya* which I found flying around a pink flowering Saxifrage, probably the larva's foodplant.

Other species new to me which I got were:—

Argynnis adippe pallida	grass slopes high above glacier, over 13000′
Argynnis aglaia vitatha	,, ,, ,, ,,
Argynnis pales sipora	,, ,, ,, ,,
Aulocera swaha gilgitica	edge of glacier, 10000′-12000′
Colias eogene francesca	grass slopes high above glacier, over 13000′
Lycænopsis ladonides gigas	,, ,, ,, ,,
Polyommatus epiron jermyni	,, ,, ,, ,,
Polyommatus sarta	

Meanwhile the Shikari had located a big herd of Ibex with, he thought, 2 or 3 good heads among them, on the far side of the Glacier. Next day, therefore, we recrossed near camp I, with 3 days' food; this crossing was a much more tedious business than the first day; the Glacier was heavily crevassed, a fact which frequently entailed long detours, and it was not till late afternoon that we had reached a suitable spot for a bivouac among the boulders and seracs.

The right bank proved to be equally productive in butterflies, and in the next week I caught several species new to me, and also shot a 42-inch Ibex, and a brown bear.

We then recrossed to the left bank and moving several miles up, sighted late one evening a small herd of 8 male Ibex, 3 of which appeared to carry better heads than we had yet seen, and after an exhausting stalk of over 16 hours, I got one of these, measuring 46 inches.

During the stalk of this Ibex, I secured a couple of the rare *Parnassius delphius chitralica* at about 15,000 ft.

On 20th August a severe snowstorm set in, lasting for 3 days, and the weather was considerably colder for some time after, but in spite of this one or two new species began to appear.

During the last week of August I explored the Kerolungma Valley and here I came across the scarce *Eumenis heydenreichi shandura* at about 11,000 ft., and secured several in good condition. From the Kero Glacier my small party of myself, Shikari, tiffin cooly and two local coolies, moved *via* the left bank to Bisal, and high up a small ravine off the main nullah, I found *Parnassius charltonius* in considerable numbers, but they were all very worn, and the only good specimen I got was a *P. jacquemonti*; this place would well repay a visit in early August.

At the beginning of September I commenced my return march, crossing to the right bank near Doku by the twig suspension bridge, and reaching Chetrun in the evening; the natural hot springs are a feature of this place, and are well built round with stone huts. Here I made the discovery that the lid of a large tin of mulberry jam, which my cook had made at Skardu, had worked off and its sticky contents were thoroughly mixed up in my only clean change of clothing. The tiffin cooly spent most of the night at the hot spring with the contents of that Yakdan!

I reached Shigar on 8th, crossing the river on a 'Zak', an inflated goat skin raft, this performance necessitated 5 trips to get the servants and baggage across.

Near Nihali village *Eumenis mniszechii droshica* were in considerable numbers round some tall thistles near the river, but these butterflies were rather worn, and had evidently been on the wing for some time.

I found a small hut, which does duty for a post office at Shigar, ankle deep in letters, from which I eventually extracted, with the help of the postmaster, 80 letters and 30 newspapers of mine, nearly all the rest belonging to the International Himalayan Expedition, which had its camp up a valley to the east of the country I had been in.

Other butterflies seen up the Chogo and Kero Glaciers were :—

Papilio machaon asiatica (larva only, on fennel).
Pararge menava mæroides R. edge of glacier.
Maniola pulchella C.
Maniola davendra brevistigma R. edge of glacier.
Karanasa hubneri hubneri N.R. at 14,000 ft.
Erebia mani R. edge of glacier.
Argynnis j. jerdoni R.
Polyommatus orbitulus astorica. R. high up, 14-16,000 ft.
Polyommatus eros janetæ C.
Polyommatus omphisa C.
Polyommatus m. metallica
Lycæna philoeas flavens N.R.
Lycæna philoeas indicus C.
Lycæna kasyapai C.
Hesperia a. alpina C.

On the 11th September I crossed the Satpa La, collecting several *Polyommatus orbitulus* in good condition on the south side of the Pass; *Parnassius e. nirius* were abundant here and I saw one *P. jacquemonti* but failed to secure it.

The next two days were spent marching across the Deosai Plateau and it may be of interest to mention that there were very few butterflies to be seen on the Plateau itself, although grass and wild flowers are to be seen everywhere; all I saw in the 35 odd miles between Ali Malik Sar and the Sar Sangri La above Borzil were a few *Pieris callidice kallora,* 1 *Maniola pulchella* and 2 *P. orbitulus.*

Between Borzil and Gurais I saw the following :—

Colias stoliczkana, in good condition.
Colias c. edusina, in good condition.
Colias p. pyale, in good condition.
Gonepteryx rhamni nepalensis, worn.
Maniola cœnonympha, worn.
Karanasa hubneri, worn.
Aulocera swaha garuna, worn.
Argynnis adippe jainadeva, in good condition.
Vanessa c. canace, in good condition.
Polyommatus eros, in good condition.
Polyommatus astrarche, in good condition.

While I was after Barasingh in the Pulwar above Bandipur, I noticed

Aulocera swaha garuna
Vanessa egea kashmira
Vanessa c. cashmirensis
Colias c. edusina

in good condition as late as 15th October at a height of 9-11,000.

It will be seen from the foregoing that a useful line for a 2-months trip in July and August would be, starting from Bandipur; Gurais-Borzil-Deosai (*via* the Satpa La) -Skardu-Arundu-Chogolungma and back.

I secured 34 species new to me from 18th July to the 10th September between Borzil and the Chogolungma.

ON THE BIONOMICS OF A BAGWORM (*KOPHENE CUPREA* M.) ON BANANA

BY

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(*With a plate and 6 text-figures*).

Introduction.

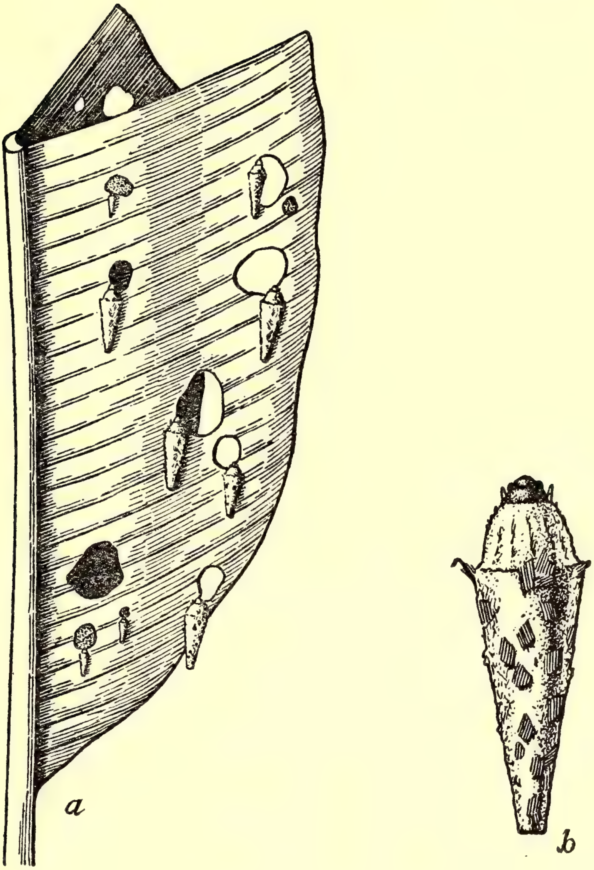
The name Bagworm is generally applied to the caterpillars of the family of moths called Psychidæ, because of the characteristic habit of carrying bags or cases with them. There is a pronounced sexual dimorphism among them in that the males are normal and winged, while the females are vermiform, legless, wingless and devoid of mouth parts and antennae. The female after laying its eggs inside its chrysalis creeps out of its bag, drops down and dies. Since very early times, the Psychids were the subject of most interesting observations by entomologists and a good deal of literature has accumulated round this group. The insects were known in Europe about the first half of the 17th century. In India, on the contrary, little attention has been paid to them; not because of their scarcity, but because they have not been found to occur frequently as serious pests of any cultivated crops; nor do they cause any appreciable injury when they occasionally appear in numbers. Apart from the scanty references to the Psychids which occur as pests occasionally sporadic on the tea plant in Assam and Ceylon, no detailed life-history of any Psychid has ever been worked out. Dr. T. V. Ramakrishna Ayyar bred two Psychids *Chaliodes vitrea* H., and *Pteroma plagiophleps* H. which recently occurred in the form of pests on tamarind at Coimbatore. This paper deals with the bionomics of *Kophene cuprea* M.

Locality and Habitat.

The writer remembers having seen this insect on banana in the South Canara district a few years ago; but it was definitely noted at Saidapet in the vicinity of Madras in March last (1937) causing appreciable damage to banana (*Musa paradisiaca*).

Nature and Extent of Damage on Banana.

The caterpillars remain on the lower surface of the plantain leaf and feed from it. The very young larvae simply scrape the epidermis. As they get older, they eat the leaf in small bits, thus causing a number of small or big irregular perforations all over the surface of the leaf, a caterpillar hanging close to each of the perforations. The number of perforations on a single leaf depends upon the number of caterpillars, which may vary from 10 to 150,



Bagworm (*Kophene cuprea*, M.) on banana leaf.
a. Caterpillars on banana leaf.
b. Caterpillar.

In a badly attacked leaf there is very little of the green tissue; consequently the plant suffers from want of nourishment. The leaves, one by one, droop down and dry up. The caterpillars which are at first confined to the lower leaves migrate to the fresher ones at the top; these in turn droop and dry, and the plant finally dies. As the leaves of the adjoining plants are long and touch each other, the migration of the caterpillars from one plant to another is easy. In a very short time, therefore, a number of plants become affected. In a garden of about 50 plants more than half were severely attacked by the pest and consequently died.

Life History and Habits.

The female moth lays from two hundred to three hundred eggs which hatch out in a week. The caterpillars immediately begin to spin their own cases, move about snail-like, feeding and growing, moulting nine times before they are completely mature. The mature larvae pupate within their own cases and the adults emerge after 7 or 8 days. The period of larval activity is the longest, lasting nearly 2½ months. The duration of the whole life cycle from oviposition to the emergence of adults is about 3 months. The length of life of the adults, male and female, after emergence varies from 2 to 4 days.

The male (*Fig.* 1) is a small moth with a small head and fairly large eyes. The antennae are bipectinated to the tips, the branches diminishing in length from the middle. The thorax is covered with brown and the abdomen with black hairs. The forewing has the same colouration as the thorax while the hind wing is fuscous like the abdomen. The fore tibia is provided with a long spine. The length of the adult from head to the tip of the abdomen is 0.8 cm. and the wing expanse from tip to tip measures 1.8 cm.

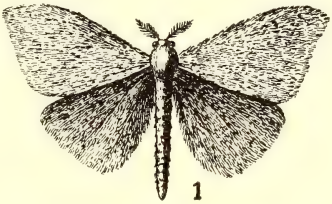


Fig. 1.

The female (*Fig.* 2) is a bag-like degenerate creature with a minute head and a large abdomen full of eggs. In the head, the eyes and the mouth parts are rudimentary while the antennae are entirely absent. The anterior and posterior pairs of wings are represented on the dorsal side of the thorax by two pairs of brownish scale-like spots. The three pairs of ambulatory legs are almost absent. On each of the abdominal segments from the 1st to the 7th, rows of very fine hairs are found. The tufts of hairs on the 8th and 9th are more strongly developed than those of the other segments. Chapman (1) found the same feature in the female of *Acanthopsyche opacella* H. Sch. The general colouration of the adult female is dirty-white and the external cuticle is so thin that the eggs contained within the abdomen can be easily seen through.

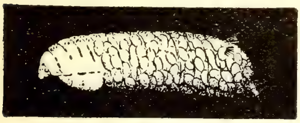


Fig. 2.

The female measure 0·8 cm. × ·3 cm. The female genitalia are prominently developed.

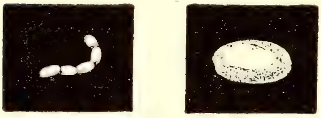
SEXUAL UNION.

As soon as the males emerge they unite with the females which are enclosed in their bags. Though copulation has not actually been observed in this particular species, it is believed the process must be same as in other Psychids. This has been described by Heylaerts (2) in his monograph on the PSYCHIDÆ. When a male finds a case in which a mature female is enclosed, it fixes itself near the narrow region of the bag, then it elongates its rather protrusible abdomen, introduces it by the side of the head of the female, and finally bending the tip of the abdomen thrusts its penis into the vaginal cavity. The copulation is completed within a few minutes. As the males are fewer than the females, a single male has to fertilise several females.

OVIPOSITION.

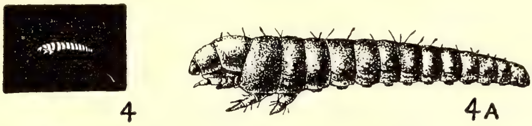
A few words may be added with regard to oviposition. Between the pupal sac and the maggot-like female there exists a space in which eggs are laid after fertilisation. Before the female makes its final exit it sheds its hairy covering found on the abdominal segments 1 to 7 to which reference has already been made. If one were to examine a female pupal case after the adult has left it, one would find at the bottom, lumps of soft powdery matter easily mistaken for some fungus. On removing this however, one sees beneath a number of eggs undergoing development. In all probability, this powdery substance is a protective covering for the developing embryos. A part of their post-embryonic life appears to be spent embedded in this substance. Evidently, the female moves up and down and rubs against the inner walls of her pupal case in order to shed the hairy covering.

The egg.—The eggs are fairly large for the size of the female, slightly ovoid in shape, shining white in colour. Each egg is 0.5 mm. long and 0.3 mm. broad. Usually the eggs are laid inside the female chrysalis as mentioned before and the hatchlings creep out of it and migrate to various parts of the host plant. But sometimes the vermiform female pushes itself out of its own case and then through the narrow region of its bag and hangs with only its terminal abdominal region outside. In such cases the eggs fall into the soil below or are not laid at all. This is the behaviour exhibited by a female which has not been fertilised by a male. After the eggs have been normally laid the female escapes through the narrow region of the case as previously mentioned, falls to the ground and dies. The eggs hatch in about 7 days.


3 3A

Eggs (Figs. 3, 3A).

Larva.—The larva when just hatched is about 1.5 mm., pale brownish in colour with a large head and the post-cephalic region gradually tapering towards the anus. In the thorax, the prothoracic segment is the largest, while the meso- and metathorax are of equal size. There are ten distinct abdominal segments which, as well as the throax, bear six rows of fine hairs rising from warts. Of the five pairs of pro-legs borne on segments 3 to 6 and 10, the last pair alone is strongly developed and the first four pairs are short. The three pairs of thoracic legs are pretty long and well developed so that, once the young larva comes in contact with the host plant, it walks only on its thoracic legs with the tapering tip of the abdomen slightly raised, thus foreshadowing the condition of the adult caterpillar within its bag. Within 2 to 6 hours after hatching the larva begins to construct the bag wherein it is to pass a large part of its life. As the larva grows, the case grows correspondingly in depth and width. After the 9th moult, the larva is fully grown. The full-grown larva (Fig. 4A) does not differ from the newly hatched one except in size. When stretched it measures 1.5 cm. in length; it has a fairly big head and a gradually tapering abdomen. The head and the thorax, which are often protruded for purposes of locomotion, are grey in colour with patches of brown; while the abdomen is of a darker hue. The larval period extends over 2½ months.


4 4A

The Larva (Figs. 4, 4A).

METHOD OF BAG MAKING.

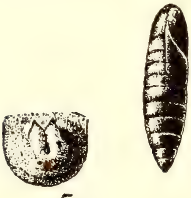
The most characteristic habit is that of bag making. Different genera of Psychids utilise different materials for the construction of their bags. Some like (*Clania crameri*) popularly called Faggot worms, utilise thorns of *Acacia arabica*, dried twigs of *Casuarina* or leaves of grasses (*Mahasena graminivora*); others like (*Amatissa consorta*) use the leaves on which they feed, a few again use feathers, thoracic plates of Chrysidids or beetles. Again, the size, shape and the mode of attachment to the host plant differ as well. In the Psychid under consideration, the case is fairly smooth and conical, ashy grey in colour and made up of cut pieces of plantain leaves stuck up on its outer surface. It was already mentioned that the young larva begins to form its own bag 2 to 6 hours after emergence from the egg. The larva cuts small bits of leaves with its mandibles which automatically adhere to the frothy mass exuding from its silk glands. When the exudation hardens, the bag is formed with leafy bits glued on to it. Then another flow of exudation runs round the rim of the bag already formed and a few more bits are added. Thus the bag grows day by day. At first, the bits of leaves appear greenish but later on, when dry, they turn ashy grey in colour. In the beginning, the case is pyramidal in shape and remains so for over a month. After this period, the growth is rapid and the bag assumes the shape of a truncated cone. The bag (*vide* plate) carried by a fully mature larva measures 1.8 cm. in depth and 0.8 cm. at its base. From the inner rim of the base of the cone there extends a diaphragm with a circular hole in the centre through which the inmate pops in and out. When the larva moves about or when it has retreated inside the bag, the diaphragm cannot be made out. In the resting position, however, it is drawn out so that the bag appears biconical.

If the bag is cut open on one side from the top to the bottom and the larva removed, it gets into the case again and in a short time begins to repair it as before. Though the line of restitching is visible externally, the internal silken lining is as perfect as before. When more than one bag is offered, the larva is not able to recognise its own case but gets into whichever is nearer.

A few words may also be added on the mode of attachment of the larva within its own bag. The last pair of abdominal legs of the larva has well developed crotchets arranged almost circularly. This and the other four pairs which are similarly supplied with circular crotchets grip the inner sides of the case and help carrying the bag from one place to another.

If the larva is removed out of its bag it curls round bringing the tapering tip of the abdomen near its head, thus hindering its progression in a straight line. Difficulty of locomotion is further accentuated by the fact that the thoracic legs are longer than the false legs whose crotchets are helpless in the gripping of the smooth surface.

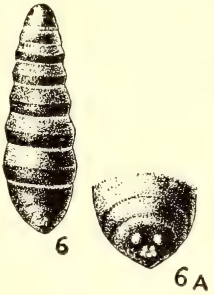
The fully grown caterpillar pupates within its own bag, the moulted skin of the final instar being attached to the cremaster hooks of the pupa. When the caterpillar is about to pupate, the head which was at the broad end of the conical case is withdrawn, the tail end which was near the narrow region is bent and pushed forward so as to lie near the broad end. By the muscular contractions of the abdomen, the head is pushed more and more towards the narrow end while the tail is brought towards the broad end. The pupation of the larva takes place in this altered position and the moth comes out through the narrow end. When the pupa wriggles out it draws along with it the last moulted skin already referred to so that in each empty case, there will be attached to the narrow region of the bag the last moulted skin and the pupal case through which the adult has emerged. The male pupa is 1 cm. long and normal like any other lepidopterous pupa, with wing pads, antennae, legs, etc. In general form it is supposed to resemble a Bombycid chrysalis from which it can, however, be distinguished by the position of two recurved hooks (Fig. 5A) found at the tip of the abdomen. The colour of the pupa is yellowish brown. The adult moth emerges in about 8 days.


5

5A

Male Pupa
(Figs. 5, 5A).

The change in the position of the mature larva before pupation already described above in the case of the male pupa also holds good in this case. But the female pupa differs remarkably from the male. Wing pads, antennae and legs are entirely absent while the eye spots are rudimentary. The head and the following three segments are slightly curved at the base and pressed together while the abdominal segments beginning from the first are large and bear impressions and excrescences. Some excrescences at the base of the three thoracic segments may indicate the presence of the feet of the larva. The stigmata are visible as also the genital opening on the 8th segment which is probably the combined vaginal and oviductal openings in the adult, a very primitive condition in the Lepidoptera. The terminal abdominal segment near the anus bears a number of protuberances. (Fig. 6A.) The general shape of the female pupa differs very much from that of the male and in fact from that of any other Lepidoptera. From the head downwards the segments get progressively bigger as far as the 7th segment and thereafter gradually taper to a blunt point. The colour of the pupa is as in the male yellowish brown and the adult female emerges from its pupal case on the 7th day.



Female Pupa (Figs. 6, 6A).

PARASITES.

No egg parasite was noted. But the larva, though much guarded by the outer bag, is subject to the attack of a small Tachinid of which two or three may be found in a single bag. The percentage of parasitism was very small varying between two to five. The Ichneumonids generally have a partiality for the Psychids. From *Clania crameri*, the author has bred the Cryptid *Goryphus nursei* Cam. An unidentified Bombylid fly has been noted as parasite on another Psychid.

ACKNOWLEDGMENT.

In conclusion the writer acknowledges his indebtedness to Dr. T. V. Ramakrishna Ayyar for his many suggestions and helpful criticisms during the course of this study and the preparation of the paper and for getting the insect identified.

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NOTES ON THE BIOLOGY OF THE FRESHWATER GREY-MULLET, *MUGIL CORSULA* HAMILTON, WITH OBSERVATIONS ON THE PROBABLE MODE OF ORIGIN OF AERIAL VISION IN FISHES.

BY

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(*With a coloured plate and 3 text-figures*).

(*Read at the Silver Jubilee Session of the Indian Science Congress Association at Calcutta, and published with permission of the Director, Zoological Survey of India*).

Grey-Mullets of the genus *Mugil* Artedi are mostly shore fishes, of which about two dozen species are known from the seas of India. Several of them enter the mouths of large rivers for breeding purposes, but a few, such as *Mugil corsula* Hamilton, *M. cascasia* Hamilton and *M. hamiltoni* Day, mostly or entirely reside in fresh waters. Of these, *M. corsula* has the remarkable habit of swimming with its eyes above the surface of the water; it attains a foot-and-a-half or more in length and usually moves in small shoals. As aerial vision is unusual among fishes, the biology of the species was studied with a view to elucidate the probable mode of evolution of this habit. Observations detailed below were made at the Calcutta Corporation Water Works at Pulta where in the settling tanks this fish is found in great abundance at all times of the year. Normally, however, it is a fluviatile species.

Hamilton,[1] who described this species in 1822, remarked:

> 'The *Corsula* (*Khorsula*) is found in most rivers of the Gangetic provinces,[2] and, in the southern parts of Bengal, has been introduced into some ponds. It grows to a foot in length, and swims with the nose and eyes above water, probably in search of insects. Although, no doubt, of a very different genus, it would seem to have much of the appearance and manners of *Cobitis anableps* (Bonnaterre, *Tabl. Encycl.*, p. 148, Pl. lxi, Fig. 240). It is very well tasted, and, by the Europeans, is much sought after for their tables.'

Day (*Fish. India*, p. 354, 1876) extended the range of the species to Burma and gave the following vernacular names:—*Kakunda*, Ooriah; *Hurd-wahre*, Punj.; *Corsula* and *In-ge-lee*, Beng., *Undala*, Hind.; *Nga-zen*, Burma.

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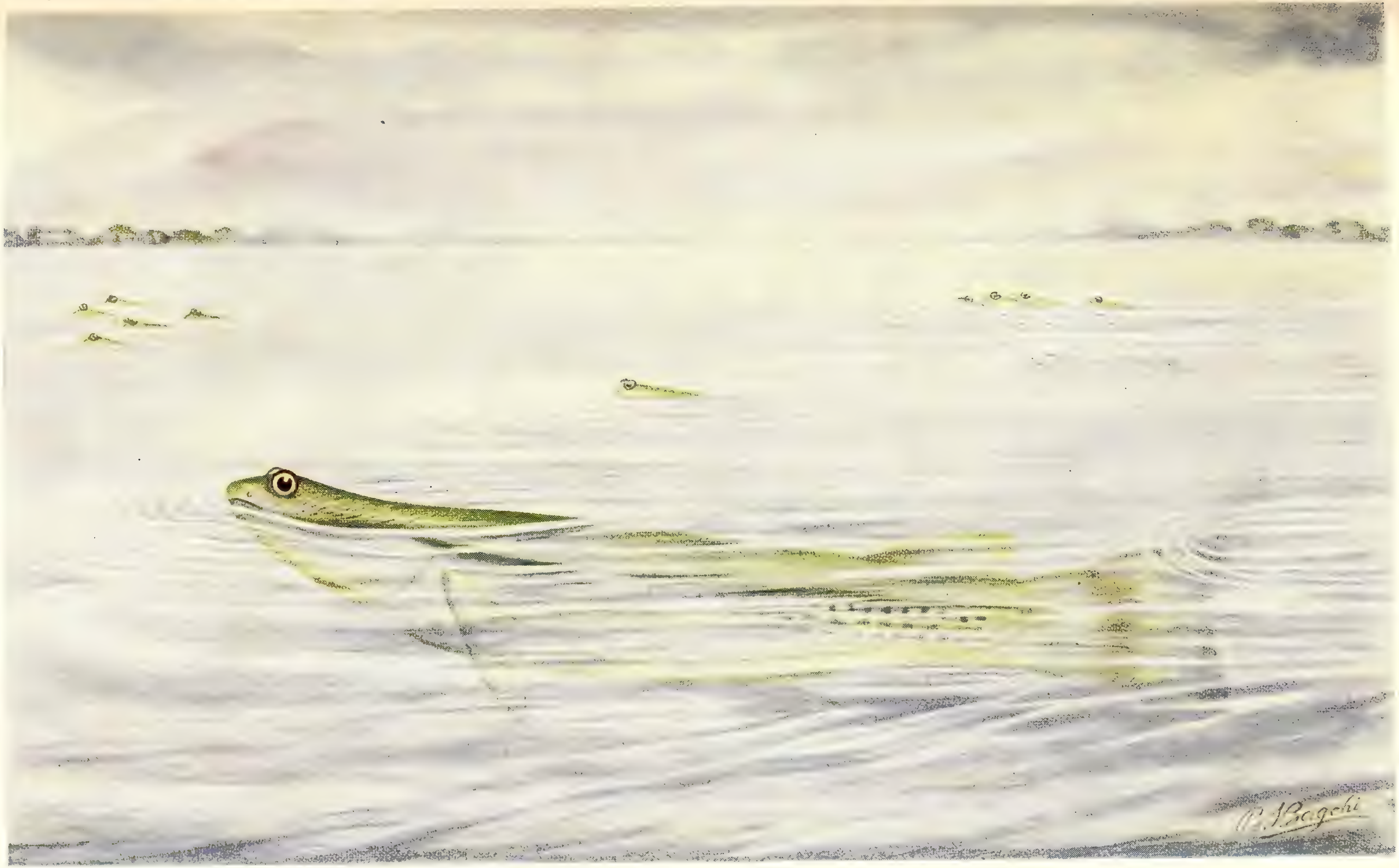
[1] Hamilton, F.—*An Account of the Fishes found in the river and its branches*. Pp. 221, 338, pl. ix, fig. 97 (Edinburgh, 1822).

[2] Day in his account of 'The Fish and Fisheries of Bengal' (Hunter's *Statistical Account of Bengal*, xx, London: 1877) published Hamilton's notes on the fish and fisheries of the various districts of Bengal. From these notes it is clear that Hamilton obtained specimens of *M. corsula* from the districts of Dinajpur, Rangpur, Purniah, Bhagalpur, Patna and Gorakhpur. He noted the following vernacular names for the species:

Dinajpur—*Ghobol*; Rangpur (Goalpara)—*Muji* and *Ingli*; Dacca—*Kholá*; Calcutta—*Khorsalá*; Purniah (Náthpur)—*Hundará*; Purniah (Bholáhat)—*Mūráil*; Bhagalpur—*Andewári*; Patna—*Angruyari*; Gorakhpur—*Bhāgā*.



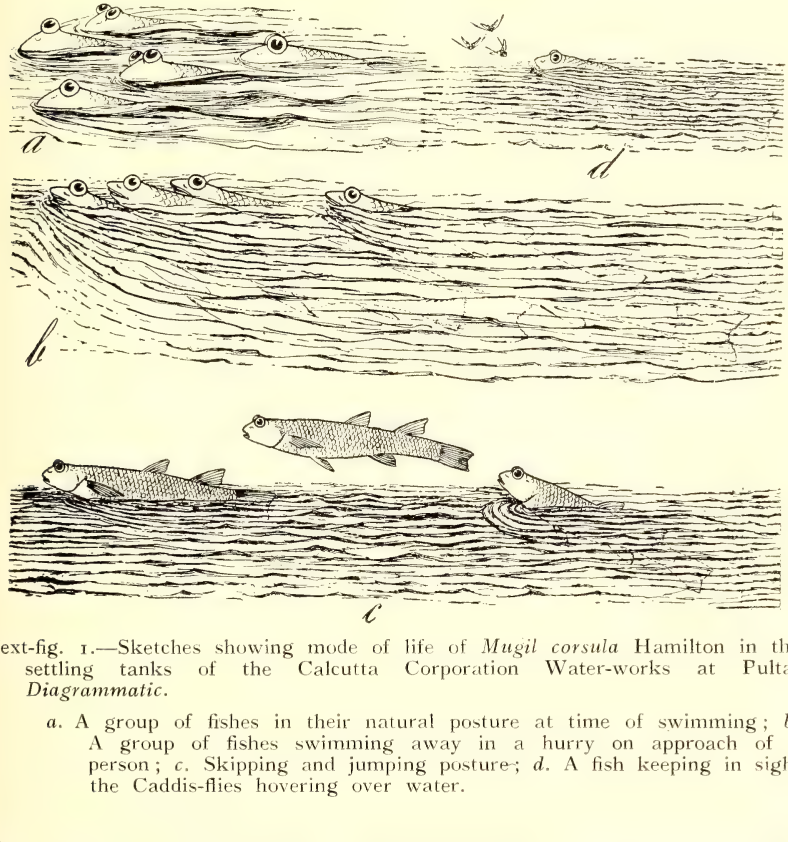
THE FRESHWATER GREY MULLET.

Mugil corsula (Hamilton).

In the Settling Tanks of the Calcutta Corporation Water-Works at Pulta.

I made observations on the locomotion, aerial vision, respiration, feeding and breeding of the species. Notes on these subjects are given below separately.

Locomotion: When the fish is swimming at the surface, the eyes, a portion of the head and the anterior part of the body are entirely out of water; the rest of the body is obliquely inclined to the surface of the water. As the fish progresses, ripples of the displaced water are formed at the sides of the head. During locomotion the pectoral fins are constantly in action, and the pelvics are held out fully stretched. The tail fin moves gently from side to side. Thus the fish moves through the water very gracefully (text-fig. 1*a*) and occasionally ducks its head below the surface, presumably to keep the eyes moist. On the approach of an individual the fish dives under water with great agility but does not stay there long and comes up to the surface at a short distance from its original position. On certain occasions the fish was observed to swim away rapidly and in this action the whole of the anterior part of the head was projected out of the water (text-fig. 1*b*), presumably to decrease resistance. Sometimes, when suddenly alarmed, it skips along the surface by using its

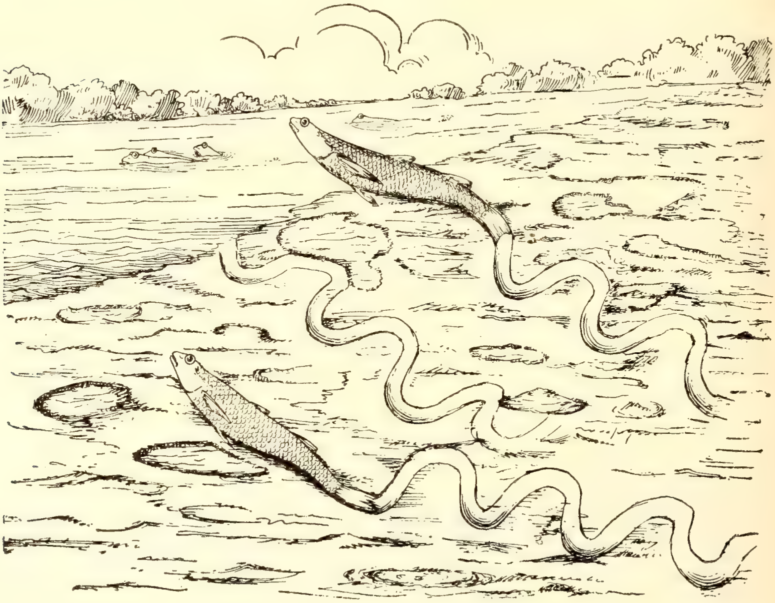


Text-fig. 1.—Sketches showing mode of life of *Mugil corsula* Hamilton in the settling tanks of the Calcutta Corporation Water-works at Pulta. *Diagrammatic.*

a. A group of fishes in their natural posture at time of swimming; *b.* A group of fishes swimming away in a hurry on approach of a person; *c.* Skipping and jumping posture; *d.* A fish keeping in sight the Caddis-flies hovering over water.

muscular tail and tail fin for giving a push to the water (text-fig. 1*c*). The skipping is done only over a very short distance after which the fish dives and clears away under cover of water.

When the water is drained away from the pucca settling tanks for cleaning them, it was observed that the fish jumps out of the receding water (the narrow channels at the bottom by which the water is finally drained off) and wanders over the muddy bottom, presumably in search of larger pieces of water. The fish could thus wander over the mud for 15 to 20 feet, but it usually halted for a few seconds in the course of a long journey. During progression through mud the posterior part of the body is whipped about vigorously and a fairly deep zig-zag track is left behind (text-fig. 2).



Text-fig. 2.—Sketch of *Mugil corsula* Hamilton wandering over mud flats in search of larger pieces of water. *Diagrammatic.* Sketches of tracks were made from a photograph.

It was further observed that in a current the fish has the habit of swimming against it.

Vision : Hamilton in describing *Mugil corsula* correctly remarked that his species had much of the appearance and manners of *Anableps* (Gronow) Scopoli, the so-called 'Four-eyed Fish' of Tropical America. 'The four-eyed fish has only two eyes but each has become divided into an upper and lower section by ingrowth of the iris. The lower pupil is shaded from the glare of the surface film by a double screen which, like horse 'blinkers', prevents the water-eyes from looking anywhere but in one direction, namely downward, where the fish's enemies prowl about'.[1] *Mugil corsula*, however, has no such bi-focal arrangement for a double vision. Its eyes are wholly out of water and are no doubt adapted mostly for an aerial vision. From a distance they shine like two white silvery balls, probably on account of the reflected light. When looked at from close quarters in an aquarium the pupil is black and the iris has a shade of orange yellow. The eye-balls can be moved in all directions, especially antero-posteriorly. Even when the fish is under water the eye-balls are moved in various directions, showing thereby that the fish is probably capable of seeing to a limited extent under water also.

In its protruding eyes, mobility of the eye-balls and perfect aerial vision, *M. corsula* agrees with the goggle-eyed fishes of the genera *Periophthalmus* Bloch & Schneider and *Periophthalmodon* Bleeker.

Respiration: Respiration is mostly aquatic, as the fish keeps its mouth under water even when a considerable part of the head and eyes are out of it. Thus for respiratory purposes the fish normally makes use of the better oxygenated water at the surface. When, however, the water of an aquarium becomes foul, the fish takes gulps of air at irregular intervals, passes them over the gills and out at the gill-openings. As with most of the tropical fishes, the gills of *M. corsula* probably subserve both for aquatic and aerial respiration.

It has been remarked above that the fish, when the water is drained away from its habitat, jumps out of the water and wriggles about on mud in search of a more congenial habitat. In such wanderings, which do not last more than a minute or two, the fish probably resorts to aerial respiration. To test the capacity of *M. corsula* for aerial respiration, a specimen was left in a dish and its surface was kept moist by occasionally sprinkling a little water over it. The experiment was started about 7 p.m. After 10 minutes, the fish was breathing air at the rate of 80 respiratory movements per minute and after about every 15 movements it took a sort of a deep breath. After about 20 minutes, the rate of respiration was the same, but a couple of minutes afterwards the animal became restless and when placed in water revived fully within a very short period. The experiment was repeated with other specimens with more or less similar results. It would thus appear that the fish, though not fully adapted for aerial respiration, is capable of living out of water for a short time.

The popular belief that *M. corsula* burrows in soft mud, when the waters dry up altogether in its habitat, is not borne out by my observations. It was found that if fishes moving on soft mud failed to reach a piece of water they lay at the surface and were usually found dead after a short time. They made no attempt to burrow, in spite of the fact that kites swooped over them from time to time and carried some of them away.

Feeding: The mouth (text-fig. 3) is angular with the upper jaw longer; it is overhung by the snout. There is a single row of fine teeth in either jaw. The lower jaw is provided with a prominent symphysial knob in the middle and corresponding to it in the upper jaw there is a deep pit to receive it. These structures are similar to those found among Carps of the subfamily Abramidinae. The alimentary canal is considerably convoluted.

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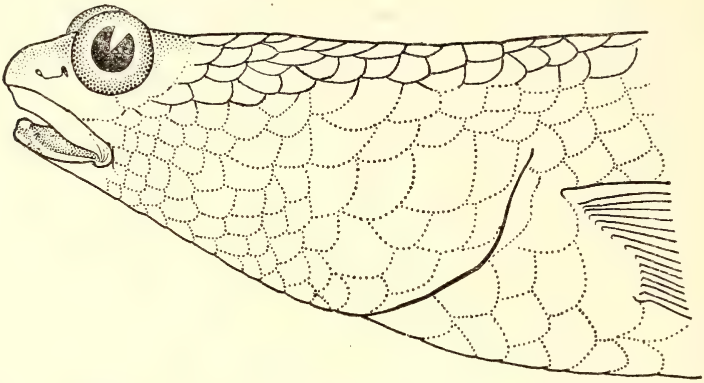
[1] Noble, G. K.—The Four-Eyed Fish. *Journ. Amer. Mus. Nat. Hist.*, xxxvi, pp. 34, 36 (1935).



Text-fig. 3.—Head and anterior part of body of *Mugil corsula* Hamilton. ×1½.

As a rule the adults living in the settling tanks of the Calcutta Corporation Water Works at Pulta feed on copious quantities of filamentous algae and one can notice them browsing near the shores in the evenings and mornings. In this process the incisor-like structure on the lower jaw probably helps in uprooting algae from the shores. When feeding, it appears from a distance as if the fish is resting near the edge of the water with a part of its head out of the water. The stomach contents of several adult specimens contained nothing but algae and a few insects and young molluscs entangled among the plants.

During May-June, when swarms of Caddis-flies (Trichoptera) are out in the evenings and hover about near the surface of the water, the fish keeps the insects in sight and usually moves about with them (text-fig. 1*d*). It was, however, never observed to jump out of the water to catch them, but as soon as an insect touched the water *M. corsula* was observed to raise its head and devour it with a jerk of the head. If, however, it missed to catch the insect at the first attempt, the insect usually started moving with great speed on the surface of the water and was chased by the fish. The fish was usually successful in its attempt. On such occasions, when there are swarms of insects, *M. corsula* feeds voraciously on insects, as within a period of 10 minutes a specimen, 6 to 8 inches in length, was noticed to devour about a dozen Caddis-flies.

The stomach contents of small specimens from 6 to 8 cms. in length were found to consist mostly of large numbers of Copepods, and sometimes small insects.

The almost toothless jaws, the presence of a symphysial knob, and convoluted alimentary canal indicate that the observed feeding habits of *M. corsula* correspond with those of the 'Carp-Minnows'

(Rasborinae) and 'Chilwas' (Abramidinae). Though the mouth of *M. corsula* is situated on the ventral surface of the head, when the eyes and a part of the head are out of water, its position becomes almost anterior and the gape becomes obliquely directed upwards and forwards, as is usually the case with the fishes that feed near the surface. Thus the anterior position of the mouth for feeding actually results from the fact that the fish keeps a greater part of its snout out of the water.

Breeding: No direct observations were made on the breeding habits of the species, but a large number of young ones appeared in the settling tanks and filter beds of the Water Works at Pulta during March and April. Presumably these months represent the peak-period of breeding for the species. *M. corsula* presumably breeds in the river and connected waters, and also in confined waters such as those of the Pulta Water Works. The presence of the fish in an isolated settling tank (Pucca Settling Tank No. 4) after cleaning shows that the fish must have come in a very early stage of development. This also indicates that *M. corsula* is in reality a fluviatile form and that its occurrence in confined waters at Pulta is only accidental.

Though *M. corsula* is at present mostly confined to fresh waters, its habits, as detailed above, seem to have been acquired under estuarine conditions during the transition period from marine to freshwater life. In the estuaries during ebb-tides certain small animals are left high and dry on muddy banks and even a few fish become stranded in small pools and puddles. The partial aerial respiration and the habit of wriggling back to water-channels, no doubt developed under these conditions, must have been of immense value to *M. corsula* in tidal creeks. Further, its habit of swimming against the current probably helped it to invade fresh waters and prevented its being carried away to the sea. Its habit of swimming near the surface was probably induced by feeding on the floating matter. Those, who have observed the incoming tides, know what an immense amount of dead and living organic stuff is collected from the mud-flats and floats on the surface layer of the water. As indicated above, the position of the mouth in *M. corsula* is ventral, but for feeding on the floating matter effort had to be made to bring the mouth to the level of the surface. The ventral profile of the head, which is sharply directed upwards (text-fig. 3), is very suggestive of such efforts having been made by the fish. In this effort the upper part of the head and the snout were continually being thrust out of the water. The eyes thus pushed out of water became gradually modified for aerial vision by an adjustment of the form of the lens. In the evolution of aerial vision the globular lens of the aquatic fishes, which is myopic both in water and on land, becomes flattened for hypermetropic vision on land. In *M. corsula* the ratio of the diameter of the lens to its thickness is as 7 : 6.

As a rule, Mullets feed on algae and other minute water plants contained in mud near the sea shore or in lagoons, but the habit of feeding on the floating matter was, in my opinion, acquired under estuarine conditions and led to the initial stages in the development of the aerial vision of *M. corsula* and also of such Gobies as *Periophthalmus* and *Periophthalmodon,* both of which possess a ventral mouth. The observed habit of *M. corsula* of browsing on algae is no doubt a secondary feature for life in confined waters. In the actual estuarine channels there is usually no growth of filamentous algae, though the connected pools may sometimes be full of them. The favourable position of the mouth must have been of great help in feeding on algae near the edges of ponds. At the present day, the fish seems to be equally well adapted for feeding both at the open surface and on the sides of a piece of water.

The terrestrial habit of the Gobies was probably acquired at a later period when during low tides they stayed on the mud-flats, instead of wriggling back to water channels as *M. corsula* does, and began to wander about in search of food. The cup-shaped ventral fins of the normal Gobies would, in the earlier stages, act as a support to enable the fish to prevent its head from sinking into the soft mud. Later the pectoral fins became modified to support the weight of the fish and a terrestrial mode of locomotion was acquired by it.

Noble (*op. cit.*) remarks that *Anableps* 'has specialised in feeding on the floating material which it encounters in its wanderings in the dual realm of air and water.' Here again it would seem probable that the richness of floating food and the comparative lack of competition in acquiring it must have induced the initial stages in the development of the remarkable modifications of the eyes in *Anableps.* *Anableps* belongs to the freshwater group of 'Top-minnows' (Cyprinodonts) which are mostly confined to fresh waters. With the exception of *Anableps,* all are small fishes, rarely exceeding 3 to 4 inches in length. As a group, they are in every way adapted for feeding near the surface and have for the same reason been used all over the world for the control of insects, especially mosquitoes. *Anableps* seems to have acquired the habit of using the upper part of its eyes for aerial vision in its search for floating organisms. Thus the primary inducement for aerial vision—feeding at the surface on floating matter—was probably the same in both the cases, but modification of the eye proceeded along different lines owing to differences in the position of the mouth in the two types of fishes. In *M. corsula* the eyes had to be wholly out of the water for the mouth to come to the level of the surface, whereas the already anterior mouth of *Anableps* had only to be slightly raised to come to the level of the surface, and hence only a part of the eyes was exposed to aerial conditions.

Noble has characterised the bi-focal vision of *Anableps* as 'The first stage in the evolution of vision in the air'; but to me it seems that such a fine arrangement, probably perfected under the circumstances detailed above, cannot be regarded as a generalised structure. At any rate, it seems probable that an aerial vision was acquired by estuarine animals of the type of *Periophthalmus, Periophthalmodon, Boleophthalmus* and *M. corsula* without undergoing the *Anableps*-stage of bi-focal vision.

MEDICINAL AND POISONOUS PLANTS OF INDIA: *MAGNOLIADS, DILLENIADS, ANONADS, MENISPERMADS, BERBERIDS.*

BY

J. F. Caius, S.J., F.L.S.

I

The Magnoliaceæ are trees or shrubs, sometimes climbing, often aromatic. They are chiefly natives of the tropical and temperate Asiatic mountains and United States, a few are Australian.

There are about 70 species belonging to 10 genera, 9 of which are used medicinally in various parts of the world:—Drimys (South America; New Zealand to Borneo); Euptelea (Japan to Bengal); Illicium (Atlantic North America; Asia); Kadsura (tropical Asia, China, Japan); Liriodendron (North America); Magnolia (Asia, North America); Michelia (tropical Asia, China); Schizandra (tropical and warm temperate Asia, North America); Talauma (eastern Asia, South America, West Indies).

Many members yield essential oils.

Among the products isolated the following may be mentioned:—(1) *cyanogenetic glucosides* and *saponins*; (2) *crystalline compounds of alkaloidal* (?) *nature*—tulipiferine—; (3) *bitter principles*—liriodendrin, magnolin, shikimin—; (4) *toxic principles*—sikimitoxin—; (5) *tannins* and *resins—;* (6) *mucilage*.

The medicinal Magnoliads of India belong to the three genera Illicium, Kadsura, and Michelia.

A. Erect trees or shrubs.	
Stipules absent. Carpels in one whorl ...	... Illicium.
Stipules conspicuous. Gynophore stalked ...	... Michelia.
B. Climbing shrubs.	
Carpels of fruit capitate	... Kadsura.

Illicium.

The genus consists of 20 species distributed over India, China, Japan, and Atlantic North America.

The fruits are aromatic, stimulant, and carminative.

The following species are used medicinally in China—*I. anisatum* Linn.—; in Indo-China—*I. anisatum* Linn., *I. Griffithii* Hook.f. & Th., *I. verum* Hook.f.—; in Malaya—*I. verum* Hook. f.—; in the Philippine Islands—*I. anisatum* Linn.—; in North America—*I. floridanum* Ell., *I. parviflorum* Michx.—.

Sikimitoxin, a highly toxic substance, has been isolated from *I. anisatum*.

The fruit of *I. verum* Hook. f. or the essential oil from it is official in Austria, Brazil, France, Germany, Great Britain, Hungary, Italy, Portugal, Russia, Spain, Sweden, Switzerland, and the United States.

The essential oil from *I. anisatum* Linn. is official in Mexico.

Illicium Griffithii Hook. fil. & Th. occurs in Bhutan and the Khasia Hills between 4,000 and 5,000 feet.

The fruit is aromatic, stimulant, and carminative.

French : Faux badianier— ; *Indo-China* : Dai hoi nui—.

KADSURA.

This genus includes 8 species, which inhabit tropical Asia, China, and Japan.

K. japonica Juss. is used medicinally in Japan.

Kadsura scandens Bl. is common in the forests of the Malay Peninsula and the Malay Islands at low elevations.

A decoction of the root is used by the Malays for rheumatism.

Malay : Akar dama daura, Akar kapala patong—.

MICHELIA.

The genus consists of 15 species inhabiting tropical Asia, and China.

The barks are bitter and aromatic, stimulant and antiperiodic.

The following are used medicinally in Indo-China—*M. Champaca* Linn. ; in Malaya and Java—*M. Champaca* Linn., *M. montana* Blum.

1. Leaves 15-25 cm. long. Flowers yellow. Sepals and petals 15 or more	*M. Champaca.*
2. Leaves 5-10 cm. long. Flowers white or with a tinge of yellow. Sepals and petals 9-12 ...	*M. nilagirica.*
3. Leaves up to 19 cm. long. Flowers white. Sepals and petals 8	*M. montana.*

1. **Michelia Champaca** Linn. occurs wild in the Eastern sub-Himalayan tract and lower hills up to 3,000 feet, Assam, Burma, Western Ghats and South India; it is much cultivated in various parts of India and Burma. It is distributed to Yunnan, Indo-China, Siam, and Malaya—not in the Malay Peninsula where, however, it is common in gardens.

The root is bitter and demulcent; it is also considered purgative.

The dried root and root-bark, mixed with curdled milk is useful as an application to abscesses, clearing away or maturing the inflammation. In the form of an infusion it is a valuable emmenagogue.

The bark has febrifugal properties; it is a stimulant, expectorant, and astringent. It is described in Ayurveda as bitter with a sharp acrid taste, causing warmth in the abdomen, destroying poisons, removing worms, facilitating micturition and sweating, useful in bile and blood affections.

A decoction of the bark was tried in sixteen mild cases of chronic gastritis. After using it for several days the patients obtained considerable relief from the pain and discomfort in the epigastrium with which they were troubled, but none of the cases was completely cured (Koman).

Ayurveda practitioners use the leaves in combination with other drugs to remove the foetid odour of vaginal discharges. In Dacca the juice of the leaves is given with honey in cases of colic.

According to Ayurveda the flowers are bitter, stomachic, diuretic; they remove bilious conditions; they are good in leprosy, skin diseases, and ulcers. Yunani doctors consider their smell a good stimulant; they use the flower as an expectorant and look upon it as useful in cough and rheumatism.

The flowers and fruits are considered bitter and cool remedies, and are used in dyspepsia, nausea, and fever. The flowers mixed with sesamum oil form an external application, which is often prescribed in vertigo; they are also applied to foetid discharges from the nostrils. They are useful as a diuretic in renal diseases and in gonorrhoea. They are considered stimulant, antispasmodic, tonic, stomachic, and carminative.

The perfumed oil prepared from the flowers is a useful application in cephalalgia, ophthalmia, and gout.

The seeds and fruit are said to be useful for healing cracks in the feet.

The flowers and the fruit in combination with other drugs are recommended as an antidote to snake and scorpion venoms, but Caius and Mhaskar have shown experimentally that both the flower and the fruit are useless in the antidotal and symptomatic treatment of snake bite and scorpion sting.

Annam: Dam bac, Su Nam—; *Assam*: Phulchopa, Phulsopa, Titasoppa—; *Bengal*: Champa, Champaka, Chumpa, Kotu—; *Bombay*: Champa, Chapha—; *Burma*: Changal, Paranyam, Saga—; *Canarese*: Champaka, Kendasampige, Kolasampige, Sampage, Sampaghy, Sampige—; *Deccan*: Champa—; *English*: Golden Champa, Yellow Champa—; *French*: Champac—; *Gujerati*: Champo, Pitochampo, Raechampo, Sonchampa—; *Hindi*: Champ, Champa, Champac, Champaca—; *Indo-China*: Kim cuong moc—; *Kathiawar*: Pilochampo, Rayachampo, Sachochampo—; *Konkani*: Champa, Champo, Pudchampo—; *Lao*: Chum pi—; *La Reunion*: Champac—; *Malay*: Bongasjampacca, Mangliet—; *Malayalam*: Champakam— *Marathi*: Kudchampa, Pivalachampa, Sonachampa—; *Matheran*: Champaka, Pilachampa, Souchampa—; *Mundari*: Champabadaru—; *Nepal*: Aulechamp, Ouliachamp—; *North Western Provinces*: Champa—; *Philippines*: Champaca, Champaga—; *Portuguese*: Champo—; *Punjab*: Chamba, Chamoti, Champa, Chamuti—; *Sadani*: Campa—; *Sanskrit*: Anjana, Atigandhaka, Bramaratithi, Bhringmohi, Chambunala, Champaka, Champeya, Deepapushpa, Gandhaphali, Hemanga, Hemapushpa, Hemapushpaka, Hemavha, Kamabana, Kanchana, Katu, Kumara, Kusuma, Kusumadhipa, Kusumadhirata, Nagapshpa, Patichampaka, Peetapushpa, Punyagandha, Rajachampaka, Shatapadatithi, Shitala, Shitalachchada, Sthiragandha, Sthirpushpa, Subhaga, Sukumara, Surabhi, Svarnachampakapaka, Svarnapushpa, Ugragandha, Vanadapika, Vanadeepa, Vanamalika, Varalbdha—; *Sinhalese*: Champak, Hapu, Sapu—; *Tagalog*: Champaga, Sampac, Sampaka, Tsampaka—; *Tamil*: Amariyam, Sambagam, Sembagam, Shampangi, Vandumarmalar—; *Telugu*: Champakmu, Champeyamu, Gandhaphali, Gangaravi, Hemangamu, Hemapushpamu, Kanjanamu, Sampangi, Sampega—; *Tulu*: Champaka, Sampay—; *Uriya*: Chompa, Chompoko—.

2. **Michelia nilagirica** Zenk. is found in the shola forests of the Nilgiris, Anamalais and Pulneys above 5,000 feet.

The bark is used as a febrifuge.

Canarese: Bilisampage, Doddasampage, Sampana, Sapage—; *Hindi*: Pilachampa—; *Marathi*: Pilachampa—; *Sinhalese*: Walsapu—; *Tamil*: Kattuchambagam, Nilagirishambagam, Shambagam—.

3. **Michelia montana** Bl. is found in the Himalaya, the mountains of Perak and Redah, and in Java.

The bark is a bitter tonic useful in fevers.

II

The Dilleniaceæ are trees or shrubs, chiefly natives of the southern hemisphere. Tropical America and Asia possess about an equal number of species; they are rare in Africa, and hitherto none have been found in South Africa or temperate South America.

4 of the 16 genera are reputed medicinal :— Curotella (tropical America, West Indies); Davilla (tropical America, West Indies); Dillenia (Indo-Malaya); Tetracera (tropics; chiefly America). Two of these—Dillenia and Tetracera—are represented in India.

I. Woody climbers; filaments dilated upwards. Carpels 2 to 5 ... ... Tetracera.
II. Trees; filaments not dilated.
  Follicles not expanding nor dehiscing enclosed in the thickened pulpy sepals; seeds not arillate ... Dillenia.

Dillenia.

This genus includes 20 Indo-Malayan species.

In Indo-China the calyces of *D. Baillonii* Pierre, *D. indica* Linn., and *D. ovata* Wall. are made into jellies and cooling drinks; the bark of *D. ovata* is used medicinally in Cambodia.

1. Flowering with the leaves; flowers large, 6 to 9 in. across, white; fruit very large ... ... *D. indica.*
2. Flowering before leaves; flowers 2 to 5 in. wide, yellow; leaves 4 in. long, oblong, blunt, velvety beneath ... ... *D. ovata.*

1. **Dillenia indica** Linn. occurs from Nepal to Assam, extending to the Malay Peninsula and Indo-China; southwards it spreads over to Ceylon.

A syrup of the juice of the unripe fruit allays coughs, assists expectoration, and cures angina and aphthae.

The juice of the fruit, mixed with sugar and water, is used as a cooling beverage in fevers, and as a cough mixture. The fruit is slightly laxative, and is apt to induce diarrhoea if too freely indulged in.

The bark and the leaves are astringent. The bruised bark is applied as a cataplasm in arthritis.

The Malays use the pulp of the fruit as a hair-wash.

Assam: Chalita, Otengah—; *Bengal*: Chalita, Chalta, Hargesa, Ruvya—; *Bombay*: Karambel, Mothakarmel, Mothekaramala—; *Burma*: Thabyu, Thibuta, Zinbrun, Zinpyunngan—; *Canarese*: Bettadakanagal, Bettakanigala, Ganagalu, Kadkanagula, Kanagala, Kanigala, Neyitaku—; *Deccan*: Mutakurmul—; *Garo*: Panpui—; *Gujerati*: Karmbal, Otaphal—; *Hindi*: Chalta, Chaltr, Girnar—; *Indo-China*: Dok shan, So ba—; *Kachin*: Masang—; *Kolami*: Korkotta—; *Konkani*: Corombol—; *Lepcha*: Kyangmozhu, Phamsikol, Phan-se kung—; *Magahi*: Chauralesi, Thapru—; *Malay*: Chimpuh, Simpoh—; *Malayalam*: Chalita, Punna, Syalita, Valapunna—; *Marathi*: Karmbel, Motakarmal, Motakarmbal—; *Monghyr*: Chilta—; *Mundari*: Korkotadaru, Kurkutadaru—; *Nepal*: Panchkule, Panchphal, Ramphal—; *Sanskrit*: Bhavya, Ruvya—; *Santal*: Korkot, Korkotta—; *Sinhalese*: Hondapara, Wampara—; *Taleing*: Carllow—; *Tamil*: Akku, Ugakkay, Uva, Uvav, Uvatteku—; *Telugu*: Kalinga, Peddakalinga, Uvva—: *Uriya*: Chalota, Oao, Ou, Rai, Uau—.

2. **Dillenia ovata** Wall. is found in the Eastern Peninsula, Malaya, Cambodia, Indo-China.

In Cambodia the astringent bark is given for diarrhoea in the form of a strong infusion.

Cambodia: Knang krepeu, Plou—; *Cochinchina*: Thu dau mot—.

TETRACERA.

The genus consists of 25 tropical species.

The following are used medicinally in the Philippine Islands—*T. indica* Merrill, *T. macrophylla* Wall.—; in Nigeria and Guinea—*T. alnifolia* Willd., *T. potatoria* Azfl.—; in Guiana—*T. alnifolia* Willd., *T. aspera* Willd., *T. ovalifolia* DC.—; in Brazil—*T. oblongata* D.C.—.

1. Follicles 3-5-seeded.
    Leaves 2-5 in. long up to 2 in. wide, toothed, glabrous except the nerves beneath ... *T. indica.*
2. Follicles 1-2-seeded.
    Leaves 3-5 in. long, oblong or lanceolate. Sepals silky inside, glabrous outside, broadly oval ... *T. laevis.*
3. Follicles 1-seeded.
    Leaves 5-7 in. long, 3-6 in. wide. Sepals silky inside, puberulous outside, obovate obtuse, edges ciliate ... ... *T. macrophylla.*

1. **Tetracera indica** Merrill (=*T. assa* DC.) is found in Eastern Bengal and the Eastern Peninsula from Chittagong to Singapore. It extends to Siam, Cochin-China, Java, and the Philippine Islands.

In the Philippines an infusion of the plant is used internally for pulmonary haemorrhage, and externally as a gargle for the treatment of aphthae.

Malay: Ampelas, Mempelas minyak, P'las payah—; *Tagalog*: Malacatmon—.

2. **Tetracera laevis** Vahl is found in the Western Peninsula, the forests of Malabar, Ceylon, Java and Borneo.

In Malabar a decoction of the leaves is mixed with rice gruel and given for the treatment of aphthae.

Malayalam: Piripu—; *Tamil*: Anaittichal—.

3. **Tetracera macrophylla** Wall. occurs in the Eastern Peninsula from Penang to Singapore, extending to Sumatra.

An infusion of the plant is used in the Philippine Islands as a drink for haemoptysis, and as a gargle for aphthae.

Malay: Ampelas gajah, Ampelas lidah kuching, Ampelas rimau, Ampelas rimbah, Mempelas gajah, Mempelas lidah kuching, Mempelas rimau, Mempelas rimbah—; *Tagalog*: Malacatmon—.

III

The ANONACEÆ are trees or shrubs, often climbing and frequently aromatic. There are 80 genera comprising 820 species, nearly all tropical, especially of the Old World.

The medicinal and poisonous Anonads of the world belong to 22 genera: ALPHONSEA (tropical Asia): ANAXAGOREA (tropical

Asia, America); Anona (Tropics; chiefly America); Artabotrys (palaeotropics); Asimina (Cuba, Mexico, Eastern United States); Bocagea (tropical America and Asia); Canangium (tropical eastern Asia to Australia); Desmos (tropical Asia); Enantia (West Africa); Goniothalamus (tropical Asia); Habzelia (tropical Asia); Hexalobus (tropical Africa, Madagascar); Melodorum (Tropics); Monodora (tropical Africa, Madagascar); Orophea (Indo-Malaya); Oxymitra (palaeotropics); Polyalthia (palaeotropics); Rollinia (tropical America); Sageraea (Indo-Malaya); Unona (tropical Asia, Africa); Uvaria (warm regions); Xylopia (Tropics).

The medicinal and poisonous Anonads of India belong to 12 genera:—Alphonsea, Anaxagorea, Anona, Artabotrys, Canangium, Desmos, Goniothalamus, Melodorum, Orophea, Polyalthia, Sageraea, Uvaria.

A. Petals 2 in 2 rows, one or both rows imbricate in bud. Stamens many. Anther-cells concealed by a flat appendage
  1. Sepals imbricate. Trees or shrubs. Ovules 6-8. Torus flat ... ... Sageraea.
  2. Sepals valvate. Climbers. Ovules many ... Uvaria.

B. Petals valvate in bud, flat, or base only concave. Inner petals similar to outer. Stamens many, with overlapping appendages. Ovaries indefinite, rarely few
  1. Petals connivent at concave base, covering stamens and ovaries. Climbers with hooked peduncles. Flowers rather large ... ... Artabotrys.
  2. Petals flat. Carpels indehiscent
    a. Trees. Ovules many in 2 rows. Stamen-appendages acute ... ... Canangium.
    b. Trees. Ovules 1-2 ... ... Polyalthia.
    c. Shrubs, half climbing. Ovules 6 in 1 row. Petals sometimes connate and reduced to 2 ... Desmos.
    d. Shrubs. Fruit follicular dehiscent ... ... Anaxagorea.

C. Petals valvate, outer spreading; inner concave connivent different, arching over stamens. Stamens and pistils numerous and anther appendages overlapping except *Orophea*. Trees. Inner petals clawed.
  1. Inner petals connivent, not vaulted. Flowers rather large ... ... Goniothalamus.
  2. Inner petals vaulted, longer than outer. Stamens 6. Orophea.

D. Petals valvate, thick, connivent; outer long narrow or broad, inner small but similar.
  1. Trees or shrubs. Ovules solitary. Fruit fleshy of many connate carpels ... ... Anona.
  2. Climbers. Ovules 2 or more. Outer petals broad. Torus convex ... ... Melodorum.

E. Petals valvate, outer often very small. Stamens definite loosely imbricate. Ovules 1 or many. Flowers usually solitary. Trees or shrubs.
  Ovaries indefinite. Petals all larger than sepals saccate at base ... ... Alphonsea.

Alphonsea.

The genus consists of 9 to 10 Indo-Malayan species.

Alphonsea ventricosa Hook. fil. & Th. occurs in Assam and Chittagong and extends to the Andamans and Penang.

The plant contains a poisonous alkaloid.

ANAXAGOREA.

The genus numbers about 8 species, natives of tropical Asia and America.

Anaxagorea Scortechinii King is found in the woods of the Malay Peninsula.

The Malays put the seeds among clothes.

Malay: Bunga lerak, Pali monyet—.

ANONA.

The genus includes 70 tropical species, especially American.

The following species are used medicinally in Senegal—*A. senegalensis* Pers.—; in Nigeria—*A. cherimolia* Mill., *A. senegalensis* Pers.—; in Guinea, Oubanghi-Chari and the Gold Coast—*A. muricata* Linn., *A. senegalensis* Pers.—; in Indo-China—*A. muricata* Linn., *A. squamosa* Linn.—; in the Philippine Islands—*A. muricata* Linn., *A. reticulata* Linn., *A. squamosa* Linn.—; in North America—*A. muricata* Linn., *A. palustris* Linn., *A. spinescens* Mart., *A. squamosa* Linn.—; in California—*A. cherimolia* Mill., *A. muricata* Linn.—; in Porto Rico and Jamaica—*A. muricata* Linn.—; in Guiana—*A. Ambotay* Aubl.—; in Brazil—*A. cherimolia* Mill., *A. Marcgravii* Mart., *A. muricata* Linn., *A. palustris* Linn., *A. Pisonis* Mart., *A. reticulata* Linn., *A. spinescens* Mart., *A. squamosa* Linn.—.

A. muricata Linn., *A. reticulata* Linn., and *A. squamosa* Linn. are used medicinally in India.

Fruit tubercled	1. *A. squamosa.*
Fruit smooth, slightly areolate	2. *A. reticulata.*
Fruit bearing numerous fleshy spines	3. *A. muricata.*

1. **Anona squamosa** Linn. is a native of the West Indies, now cultivated throughout India.

The root is considered a drastic purgative, and is administered in acute dysentery. It is also employed internally in depression of spirits and in spinal diseases.

The astringent bark is used as an antidiarrhoeal cure in Cambodia.

An infusion of the leaves is considered efficacious in prolapsus ani of children; and the bruised leaves with salt make a cataplasm to induce suppuration.

In Brazil they are applied as a poultice over boils and ulcers. In Gambia, the West Indies, Central and South America they are used to kill lice and to prevent bed bugs, etc.

The ripe fruit is medicinally considered a maturant; and when bruised and mixed with salt, is applied to malignant tumours to hasten suppuration. The seeds contain an acrid principle fatal to insects, and the dried unripe fruit, powdered and mixed with gram flour, is used to destroy vermin.

In Chota Nagpur the seeds are crushed and used for destroying worms in the wounds of cattle.

The seeds are a powerful irritant of the conjunctiva.

Annam: Mak khieb, Mang cau ta, Qua na, Tiep—; *Antilles*: Cachimant, Hattier, Pomme-canelle—; *Arabic*: Ambeberesch, Beresch, Chermisch, Saripha—; *Assam*: Ata, Katal—; *Bengal*: Ata, Luna, Meba, Sitaphal—; *Brazil*: Ata, Pinha, Frutta de Condessa—; *Burma*: Auza—; *Cambodia*: Tiep srok—; *Canarese*: Amritaphala, Duranji, Sitaphala—; *Ceylon*: Anoda—; *Cuba*: Anon—; *Deccan*: At, Sitaphul—; *English*: Custard Apple, Sugar apple, Sweet Sop—; *Ewe*: Eevunyikleng—; *Fanti*: Apre—; *French*: Anone écailleuse, Ate, Attier, Cachiman, Guanabane, Hattier, Marie baise, Pomme canelle—; *Ga*: Ngawyei, Nangwi, Ngaasie—; *Guam*: Atis—; *Gujerati*: Anan, Anuram, Seetaphul, Sitaphal—; *Hasada*: Sarupa—; *Hindi*: At, Ata, Atasitaphal, Saripha, Shariphal, Sitaphal—; *Ibo*: Mbubo-ago—; *Indo-China*: Phan le chi—; *Kolami*: Mandal, Nenwa—; *Konkani*: At, Ath—; *Krobo*: Hangbue—; *Lambadi*: Sitaphal—; *La Reunion*: Attier—; *Malay*: Mannapapuwa, Srikaya—; *Malayalam*: Antacheecha, Attachchakka, Sirpa, Sitapalam, Sutakanni—; *Marathi*: At, Sitaphal—; *Mexico*: Anona, Anona blanca—; *Mundari*: Borordaru, Neoa, Sampa, Sarupa—; *Nagpuri*: Neoa—; *Nepal*: Sharifal—; *North-Western Provinces*: Behli, Sharifa—; *Persian*: Kaj, Sharifah—; *Portuguese*: Ateira, Fructo de Conde—; *Puerto Rico*: Anon, Anona con escamas, Atis—; *Punjabi*: Sharifa—; *Sanskrit*: Agrimakhya, Atripya, Bahubijaka, Gandagatra, Krishnabija, Sitaphala, Subha, Suda, Vaidehivallabha—; *Sakalave*: Konkony—; *Santal*: Mandargom—; *Sind*: Sharifa—; *Sinhalese*: Anoda, Atta—; *Sumatra*: Sirikayu—; *Tagalog*: Ates—; *Tamil*: Atta, Sitapalam—; *Telugu*: Gandagatramu, Sitapandu, Sitaphalamu—; *Timne*: Momina—; *Tulu*: Amritakay—; *Twi*: Apre, Bororfo nyankonga—; *Uriya*: Ato, Sitapholo—.

2. **Anona reticulata** Linn. is a native of the West Indies, now cultivated in India.

The bark is a powerful astringent, and is used as a tonic by the Malays. In China it is used in the treatment of inflammation of the eye.

In Brazil the leaves are used as a maturant.

In the West Indies and in Central and South America the green fruit is much used as an antidysenteric and an anthelmintic.

A. de Santos has isolated from the bark of the trunk an alkaloid which he has named *anonaine*.

Antilles: Cachimen, Coeur de boeuf, Corossol réticulé, Mamilier—; *Bengal*: Luvuni, Nona—; *Bombay*: Ramphal—; *Burma*: Awza—; *Canarese*: Ramaphala, Ramphal—; *Ceylon*: Anona—; *Chinese*: Meng Pa—; *Cuba*: Anona, Mamon—; *Deccan*: Ramphal—; *English*: Bullock's Heart, Custard Apple, Netted Custard Apple—; *French*: Anone en réseau, Cherimolier, Mamilier—; *Goa*: Anona—; *Guam*: Anonas—; *Gujerati*: Ramphal—; *Haïti*: Guanabano—; *Hindi*: Anta, Luvuni, Nagnewa, Nona, Ramphal—; *Hova*: Voankobohobo—; *Konkani*: Anon—; *La Reunion*: Anone, Coeur de boeuf—; *Malay*: Manua, Nona, Nona Kapri—; *Malayalam*: Manilanilam, Parankichchakka, Ramachchita—; *Marathi*: Ramphal—; *Mexico*: Anona, Ilama—; *Mundari*: Nagneva—; *Philippines*: Anonas—; *Portuguese*: Anona—; *Puerto Rico*: Anona de redecilla, Corazon—; *Sakalave*: Hobohobo—; *Sanskrit*: Krishnabija, Lavali, Lavani, Mriduphala, Raktatvatch, Ramawhaya, Ramphala, Vasanta—; *Santal*: Gom—; *Seychelles*: Coeur de boeuf—; *Sinhalese*: Anoda—; *Tamil*: Aninuna, Ramachita, Manilayatta—; *Telugu*: Ramaphalamu, Ramasitaphalamu—; *Uriya*: Barhial, Neua, Ramopholo, Ramositapholo—; *Venezuela*: Rinon—.

3. **Anona muricata** Linn. is a native of tropical America, now common in the tropics of the Old World.

In La Reunion the root is considered antispasmodic and parasiticidal; the leaves are given in fevers, and also used in the form of a poultice to produce suppuration; the flower buds and the flowers are considered an excellent remedy for cough; the unripe fruits when dried and powdered are given in chronic dysentery, and they are used for aphthae in the form of a decoction; the seeds are valued for their astringent and emetic properties.

In Jamaica a decoction of the root is said to be an antidote against fish-poison.

In Southern California and Tropical America the bark is used as a drastic purgative.

In Brazil the leaves are steeped in hot water or ground with oil, and used as a maturant. An infusion of the leaves is used as a remedy for dysentery in Porto Rico. In general the leaves are regarded as a useful remedy for fever and dysentery. In Guinea they are pounded and applied fresh to cicatrice wounds. In Gambia they are used to get rid of bed bugs.

The seeds are emetic and astringent. In Southern California and Tropical America they are said to be poisonous and they are used as a parasiticide and an insecticide; they are used to poison fish.

Akim: Abrorfontunkum—; *Antillas*: Anona de puntitas—; *Antilles*: Anone en bouclier, Cachiman épineuse, Corossol montagne, Grand corossol, Sapadille—; *California*: Guanabana, Sour-sop—; *Canarese*: Mulluramphala—; *Cartagena*: Anona de broquel, Catuche, Guanabana—; *English*: Sour sop—; *Ewe*: Vo, Voti, Votsi—; *Fanti*: Apre—; *French*: Corrossolier—; *Fula*: Dukumeporto—; *Ga*: Aluguntungung, Nkrangmrobe—; *Guam*: Laguaná—; *Indo-China*: Mak khieb thet, Mang cau xiem, Tiep parang—; *Krepi*: Yevunyakle—; *Krobo*: Alukutum—; *La Reunion*: Corossol—; *Malayalam*: Mullanjakka, Vilattinuna—; *Mexico*: Anona, Anona amarilla, Cabeza de negro, Catuche, Guanabano—; *Peru*: Guanabano—; *Philippines*: Goyabrano, Guanabano—; *Sakalave*: Kaoraosaly—; *Sinhalese*: Katuanoda—; *Tamil*: Mulluchitta, Pulippala—; *Tschaudjo*: Alola—; *Twi*: Aduatungnkungm, Apre, Deboo, Nkrangmrobe—.

ARTABOTRYS.

This genus consists of 30 species distributed over the tropics of the Old World.

A. odoratissimus R. Br. is used medicinally in Indo-China, the Philippine Islands, the Malay Archipelago; *A. suaveolens* Bl. in Java.

1. Limb of petals broad, lanceolate or elliptic-oblong ... 1. *A. odoratissimus.*
2. Limb of outer or all the petals linear, narrow-oblong, or subclavate ... ... 2. *A. suaveolens.*

1. **Artabotrys odoratissimus** R. Br. is largely cultivated in India, Ceylon, Java and China.

A decoction of the leaves is given for cholera in some of the islands of the Malay Archipelago.

Bombay: Vilayatichampa—; *Canarese*: Kandalisampage, Manoranjanballi—; *Deccan*: Madanmast, Madmanti—; *Hindi*: Champa—; *Indo-China*: Day cong chua—; *Malayalam*: Madanakameswari, Manoranjitam—; *Philippines*: Ilang-ilang de China—; *Sanskrit*: Harachampaka, Nilachampaka, Phalasampenga—; *Southern California*: Climbing Vine, Climbing Ylang-ylang—; *Tagalog*: Alagalag sonson, Alangilang sonson—; *Tamil*: Manoranjidam—; *Telugu*: Manoranjidamu, Muddasampenga, Phalasampanga, Sakalaphalasampanga—; *Uriya*: Kalomuro, Monasocompa—.

2. **Artabotrys suaveolens** Bl. is found in Sylhet, Chittagong, Mergui, the Malay Peninsula and the Malay Islands.

The Malays use the leaves to prepare an aromatic infusion whose good effects have been extolled in the treatment of cholera.

Malay: Akar chenana, Durie carban—.

CANANGIUM.

This genus consists of 3 species inhabiting tropical Eastern Asia and extending through Burma to New Guinea and the Philippine Islands.

1. Leaves glabrous. Flowers over 2 in. long ... *C. odoratum.*
2. Leaves ovate to orbicular, woolly beneath, deciduous. Flowers large ... ... *C. latifolium.*

1. **Canangium odoratum** Baill. is cultivated throughout India. From Ava and Tenasserim it extends to Java.

The flowers yield the 'ilang-ilang' of perfumes. 'Cananga Oil' consists of the early portions of the distillate.

The oil is used as an application in cephalalgia, ophthalmia, and gout.

Burma: Kadapnyan, Kadatnyan—; *Canarese*: Apurvachampaka—; *English*: Ylang-ylang—; *French*: Bois de Bananen, Bois de lance bâtard, Caneng aromatique—; *Guam*: Alangilang—; *Ilocano*: Alangilang, Ilangilang—; *Jolo*: Angilang—; *Malay*: Cananga, Ilangilang, Kenanga—; *Rarotonga*: Moto-oi—; *Samoa*: Moso'oi—; *Sinhalese*: Wanasapu—; *Tagalog*: Alangilang, Ilangilang—; *Tamil*: Karumugai, Maladi, Maramanoranjidam, Sadi, Sirusambagam—; *Telugu*: Apurvachampakamu—; *Visayan*: Alangilang, Ilangilang—.

2. **Canangium latifolium** Pierre is distributed over Burma, the Malay Peninsula, and Cambodia.

In Indo-China the wood is considered a febrifuge.

Indo-China: Su tay, Tai nghe, Tom xui—.

DESMOS.

This genus numbers 20 species inhabiting tropical Asia.

Flower opposite leaf. Leaves glabrous.
1. Pedicel 4 to 6 in. long; leaves hardly glaucous beneath ... ... *D. cochinchinensis.*
2. Pedicel 1 to 2 in. long; leaves quite glaucous beneath *D. chinensis.*

1. **Desmos cochinchinensis** Lour. is found in Assam, the Malay Peninsula, and Cochin-China.

The Malays use a decoction of the roots for fever.

Malay: Akar sugi-sugi, Larak salai—.

2. **Desmos chinensis** Lour. occurs in East Himalaya, Burma, the Malay Peninsula and Islands, and Cochin-China.

The Malays use a decoction of the plant for dysentery.

Malay: Akar darah, Akar mariam, Akar singa, Kenanga hutan, Poko sikenchong—,

GONIOTHALAMUS.

The genus includes about 50 species distributed over tropical Asia.

Goniothalamus macrophyllus Hook. fil. is common in woods all over the Malay Peninsula whence it extends to Sumatra and Java.

The wood is aromatic. The plant is used medicinally by the Malays.

Malay : Bongsoi, Penawar hitam—.

MELODORUM.

The genus consists of about 40 species found in tropical Asia, Africa, and Australia.

Melodorum Kingii Boerl. is found in the forests of Malacca and Perak.

A decoction of the flowers is used by the Malays for dyspepsia.

Malay : Poko achar—.

OROPHEA.

This genus consists of 30 Indo-Malayan species.

Inner petals vaulted.
  Stamens 12 ; stem hairy ; carpels globose ... ... 1. *O. setosa.*
  Stamens 6 ; stem hairy ; carpels globose ... ... 2. *O. hirsuta.*

1. **Orophea setosa** King is found in the woods of Perak and Negri Sembilan from 500 or 1,200 ft. altitude.

A decoction of the roots is used by the Malays in malaria.

Malay : Pialu—.

2. **Orophea hirsuta** King inhabits Perak, where it is however rare.

The Malays chew the plant with betel-nut in cases of cough.

Malay : Supucha pelandok—.

POLYALTHIA.

The genus includes 70 palaeotropical species; mostly in tropical Asia, a few in Africa and Australasia.

P. Oliveri Engl. is used medicinally in Sierra Leone, Liberia, and parts of Cameroon.

1. Leaves narrow, lanceolate, undulate ... ... 1. *P. longifolia.*
2. Leaves oblong ... ... 2. *P. simiarum.*

1. **Polyalthia longifolia** Benth. and Hook. fil. is cultivated throughout the hotter parts of India.

The bark is used as a febrifuge in the Balasore District of Orissa.

Bengal : Debdaru, Devadar, Devadaru— ; *Bombay* : Asok, Asoka, Asopalav, Asupal, Asupala, Devadaru— ; *Canarese* : Putrajivi— ; *Ceylon* : Maraillupai— ; *English* : Indian Fir, Mast Tree— ; *Gujerati* : Ashopalo— ; *Hindi* : Asok, Debdari, Deodar, Devadar, Devadaru, Devidari— ; *Konkani* : Assok, Devandaru— ; *Madras* : Nettilingam— ; *Malayalam* : Aranei, Aruna, Ashokam, Ashvattam, Chorani, Hemapushpam, Vanjolam— ; *Sanskrit* : Devadaru, Putrajiva— ; *Tamil* : Asogam, Asuvattai, Kalgoli, Kasubam, Kolikkudi, Nettilingu, Pundi, Ravadam, Saribam, Selai, Sendu, Tevadaram, Vansulam— ; *Telugu* : Asokamu, Asvattamu, Devadaru— ; *Tulu* : Asoka— ; *Uriya* : Debodaru, Asoka, Oswottho, Putikashto—.

2. **Polyalthia simiarum** Benth. and Hook. fil. is found in Orissa, Pegu Yoma, Martaban and Tenasserim.

The bark is used in Orissa as a cure for scorpion sting.

Bhuia: Champa—; *Modesia*: Khari—; *Nepal*: Khutti, Labshi—; *Orissa*: Mongai, Ojarh, Mojarh—; *Santali*: Dighibentia—.

SAGERAEA.

The genus consists of 6 Indo-Malayan species.

Sageraea laurifolia Blatter occurs in South Konkan.

The leaves have a pungent, astringent, and bitter taste. In the Konkan they are used for fomentation.

Bombay: Andi—; *Canarese*: Sagare—; *Konkani*: Sageree—; *Marathi*: Harkinjal, Sageri, Undie—.

UVARIA.

The genus numbers 100 species distributed over the Tropics of the Old World.

V. Chamae P. Beauv. is used medicinally in Gold Coast, Sierra Leone, Togo, Lagos, and Senegal; *V. Afzelii* Scott Elliot in Liberia; *V. calamistrata* Hance in Indo-China.

1. Stamens all cuneate ... ... 1. *U. Narum.*
2. Outer stamens flat ... ... 2. *U. dulcis.*

1. **Uvaria Narum** Bl. occurs in the Bombay Presidency—Konkan and North Kanara—, and the Madras Presidency—forests of the Western Ghats from South Kanara to Travancore, and hills of Salem up to 4,000 feet.

The oil obtained from the roots by distillation, as well as the root, are used medicinally in various diseases. The root is fragrant and aromatic, and the bruised leaves smell like cinnamon.

Canarese: Kariballi, Unamini—; *Malayalam*: Narampanal—; *Matheran*: Narampanal—; *Tamil*: Pulichan—; *Tulu*: Pandel—.

2. **Uvaria dulcis** Dunal occurs in Burma, the Malay Peninsula, Java and the Philippines.

The bark of the root has astringent, stimulant, and alterative properties.

Malay: Pisang-pisang hitam—; *Visayan*: Dalaganum, Dalagao—.

IV

The MENISPERMACEAE are scandent or twining shrubs, found chiefly in the tropics of the Old and New World. They number 65 genera and 360 species. Many of them figure among the poisonous plants used in making arrow and dart poisons.

The medicinal and poisonous Menispermads of the world belong to 21 genera:—ABUTA (tropical South America); ANAMIRTA (Indo-Malaya); ANOMOSPERMUM (Brazil, Guiana); BURASAIA (Madagascar); CISSAMPELOS (tropical and subtropical regions); COCCULUS (tropical and subtropical regions); COSCINIUM (Indo-Malaya); CYCLEA (tropical Asia); FIBRAUREA (tropical and subtropical Asia); JATRORRHIZA (tropical Africa); MENISPERMUM (eastern Asia, Atlantic North America); PACHYGONE (eastern Indo-Malaya); PENIANTHUS (western tropical Africa); PERICAMPYLUS (eastern Indo-Malaya); SPHENOCENTRUM (western tropical Africa); SPIROSPERMUM (Madagascar); STEPHANIA (palaeotropics); STRYCHNOPSIS (Madagascar); TILIACORA (Indo-Malaya); TINOMISCIUM (tropical Asia); TINOSPORA (Palaeotropics).

The following are among the products isolated:—(1) *alkaloids*—bebeerine, isobebeerine, beta-bebeerine, berberine, buxine, chondrodine, curarine, menispermine, para-menispermine, pelosine, sangoline, tiliacorine—; (2) *quaternary bases* (none of which has been obtained in a free state)—columbamin, jatrorrhizin, palmatin—; (3) *crystalline bitter principles*—anamyrtin, columbin, picrotoxin, picrotoxinin, trilobin—; (4) *acids*—columbic, picrotoxic—.

The medicinal and poisonous Menispermads of India belong to 12 genera:—ANAMIRTA, CISSAMPELOS, COCCULUS, COSCINIUM, FIBRAUREA, JATRORRHIZA, PACHYGONE, PERICAMPYLUS, STEPHANIA, TILIACORA, TINOMISCIUM, TINOSPORA.

A. Flowers trimerous. Ovaries usually 3. Drupes with a subterminal, rarely ventral or basal style-scar. Seeds oblong or subglobose	
1. Sepals 6. Stamens 6 or 3, often connate ...	JATRORRHIZA.
2. Sepals 6. Petals 6. Filaments free ...	TINOSPORA.
3. Sepals 9. Petals 6. Filaments free	TINOMISCIUM.
4. Sepals 6. Petals 0. Filaments free	FIBRAUREA.
5. Sepals 6. Filaments all connate	ANAMIRTA.
6. Sepals 9. Outer filaments free	COSCINIUM.
B. Flowers trimerous. Ovaries usually 3. Drupe with a subbasal, rarely subterminal style-scar. Seed horseshoe-shaped. Albumen copious. Embryo slender, cotyledons linear or slightly dilated	
1. Petals 6, minute. Ovaries 3-12. Style subulate ...	TILIACORA.
2. Petals 6. Ovaries 3-6. Styles subulate	COCCULUS.
3. Petals 6. Ovaries 3. Styles forked	PERICAMPYLUS.
C. Flowers 3-5-merous. Ovaries usually solitary. Drupe with a subbasal style-scar; endocarp dorsally muricate or echinate. Seeds horseshoe-shaped. Embryo linear; cotyledons appressed	
1. Sepals 6-10, free. Petals of male flower and female 3-5, free	STEPHANIA.
2. Sepals 4, free. Petals of male 4, connate, of female 1	CISSAMPELOS.
D. Flowers usually trimerous. Ovaries usually 3. Drupes with a subbasal or ventral style-scar. Seed curved, hooked or inflexed.	
Sepals, petals and stamens 6 each	PACHYGONE.

ANAMIRTA.

The only Indian species of this genus, **A. paniculata** Colebr. is found in the Khasia Hills, Assam, Eastern Bengal, from Orissa and the Bombay Konkan to Ceylon; it extends through the Malay Archipelago to New Guinea.

According to Yunani authors the berry is slightly bitter, expectorant, demulcent, and carminative; useful in the treatment of rheumatism; poisonous to fish.

The bitter berries are sometimes used in the form of an ointment. This ointment is employed as an insecticide to destroy pediculi, and in some obstinate forms of chronic skin diseases. Koman prepared an ointment containing 80 grains of finely powdered seeds to one ounce of vaseline, and used it as an external application in ringworm; cases of one to two months' duration were cured by a few days application, but chronic cases did not derive benefit.

The fresh leaves are used in Bengal as a snuff in the treatment of quotidian ague.

In Ceylon the bruised fresh bark is applied to the bitten part in cases of snake-bite. But Mhaskar and Caius have found that the bark, leaves, and berries are equally useless as an external application in the treatment of snake-bite.

The seeds are used in the nightsweats of phthisis.

The jungle tribes of the Malay Peninsula use the plant to poison their arrows and their kriss.

Both its poisonous properties and any therapeutic virtues the plant may contain depend upon picrotoxin of which the fruit is the source. The plant also contains two minor alkaloids of unknown constitution, menispermine and paramenispermine, both physiologically inactive.

Arabic : Mahijehreh—; *Bengal* : Kakamari—; *Bombay* : Kakaphala, Kakphal, Vatoli—; *Burma* : Hong—; *Calcutta* : Bacaenkaphal—; *Canarese* : Kakamari, Kakkisoppugade—; *Deccan* : Kakmari—; *Dutch* : Indiaansche rezies, Koklus—; *English* : Crow Killer, Fish Berry, Fish Killer, Indian Berry, Indian Cockles, Louse Berry, Oriental Berries, Poison Berry—; *French* : Arbre à enivrer, Bois à enivrer, Bois enivrant, Bois ivrant, Coque du Levant, Coque Levant, Herbe à tous maux, Pareire à feuilles rondes—; *German* : Fischkoerner baum, Kokkelskoernerbaum, Tollkoernerbaum—; *Gujerati* : Jermae, Kakaphula, Kakmari—; *Hindi* : Jermae, Kakmari—; *Indo-China* : Ben nau, Day tao, Seg Dom—; *Italian* : Coccole d'India—; *Konkan* : Garudphul, Kadul—; *Malay* : Dawonnboelann, Tubabidji—; *Malayalam* : Anakrytu, Garalaphala, Garaphala, Kantakakonnuveli, Kantakakunavam, Karantakam, Miunannu, Machattinkaya, Nanninkuru, Pola, Pullukunavam—; *Oceania* : Lacton, Lagton, Libtang, Soma, Suma, Tubaflava—; *Pampangan* : Balasin, Bayati, Lactang, Lanta, Lictang, Lingtangbaguin, Suma, Tuba—; *Persian* : Mahijehreh—; *Philippines* : Abutra, Pangmavan—; *Portuguese* : Coca de Levante, Fruta matapeixe—; *Sanskrit* : Garalaphala, Kakahva, Kakamari, Kakanashika—; *Sinhalese* : Pangan, Tittawel—; *Spanish* : Coca de Levante, Coca levantina—; *Tagalog* : Balasin, Bayati, Lactang, Lanta, Lictang, Lingtangbaguin, Suma, Tuba—; *Telugu* : Kakamari, Kakichempoo, Koditige, Tippatige—; *Tulu* : Chipulu—; *Urdu* : Mahijehreh—; *Uriya* : Kalabiti Nai, Kaumari—; *Visayan* : Balasin, Bayati, Lactang, Lagtal, Lanta, Lictang, Lintangbaguin, Suma, Tuba—.

CISSAMPELOS.

This genus includes 21 species inhabiting the warm regions of the world.

The following are used medicinally in the Philippine Islands and Indo-China—*C. Pareira* Linn.—; in the Antilles and Guiana—*C. Pareira* Linn.—; in South America—*C. caapeba* Linn., *C. Pareira* Linn.—; in Brazil—*C. glaberrima* St. Hil., *C. ovalifolia* DC.—; in the Gold Coast and in Nigeria—*C. mucronata* A. Rich., *C. owariensis* P. Beauv.—; in Southern Africa—*C. angustifolia* Bucch., *C. capensis* Thunb., *C. mucronata* A. Rich., *C. Pareira* Linn., *C. torulosa* E. Mey.—; in Mauritius—*C. mauritiana* Pet. Th.—.

Cissampelos Pareira Linn. occurs throughout tropical and subtropical India; and throughout the warm parts of Asia, East Africa, and America.

The root is the part most esteemed; it has an agreeable, bitterish taste, and is considered a valuable stomachic. It is frequently prescribed in the later stages of bowel complaints, in conjunction with aromatics. It is given for pains in the stomach and for dyspepsia, diarrhoea, dropsy and cough; also for prolapsus uteri. It is applied externally in snake-bite and scorpion-sting.

Among the Mundas of Chota Nagpur the root, ground and mixed with water, is used against stomach-ache and diarrhoea, especially against infantile diorrhoea.

In Hausaland the bitter root is sold as a medicine for many purposes.

The Chuanas, Subias, and Kobas of South Africa drink an infusion of the powdered root for stomach-ache. The Filabusi natives and the Xosas drink a similar preparation for snake-bite. The Pedis use a decoction of the root as a wash for children who have pimples over their body.

In Madagascar the root is considered diuretic, emmenagogue, and antipyretic; it is given for urinary gravel.

In La Reunion the bitter root is considered tonic, stomachic, and diuretic; and it is used in the treatment of bladder troubles.

In French Guiana the roots are used as a diuretic in cases of dysuria and calcular nephritis. An infusion is expectorant and is considered a potent alexiteric.

The root acts as an antiseptic of the bladder and is used in chronic inflammation of the urinary passages. In Yoruba it is used as an anti-emmenagogue.

The leaves are said to have a peculiarly cooling quality, and they are used locally in cases of unhealthy sores and sinuses. In the Gold Coast they are applied to abscesses. The Xosas apply a paste of the leaf to wounds.

The root in combination with other drugs is an Ayurveda cure for snake-bite and scorpion-sting. Mhaskar and Caius have, however, demonstrated that the root is not an antidote to snake venom and that it is useless as an external application in the treatment of scorpion-sting.

The root contains the alkaloid bebeerine. It is official in Portugal.

Annam: Moi tron, Tiet re—; *Antsianaka*: Voaravinaviavy—; *Ashanti*: Akuraso—; *Batangas*: Calancalamayan—; *Bengal*: Akanadi, Nemuka, Nimuka, Tejomalla—; *Betsileo*: Vahemboatavo—; *Betsimisaraka*: Vahifotsy—; *Bombay*: Pahadmul, Pahadvel, Venivel—; *Canarese*: Padavali—; *Cebu*: Batangbatang—; *Chuana*: Mokaekae—; *Dehra Dun*: Parhe, Purhe—; *East Africa*: Kinukadjio—; *English*: False Pareira brava, Ice Vine, Velvet-leaf—; *Filabusi*: M'cessie—; *French*: Faux pareira brava, Liane à glacer l'eau, Liane à serpents—; *French Guiana*: Pareira brava, Paria brava—; *Garhwal*: Pahari, Parhe—; *Goa*: Parayel—; *Gujerati*: Venivel—; *Hausa*: Fiyaka, Jibdakassa, Judarkas, Piyaka—; *Hindi*: Akanadi, Dakhnirbissi, Harjeuri, Harjori, Pari—; *Hova*: Vahivory, Voriravina—; *Ilocano*: Cuscusipa—; *Java*: Areujtjantjuan—; *Koba*: Mokaekae—; *Kolami*: Pitu-singh, Ranu-sed—; *La Reunion*: Liane blanche, Pareira brava—; *Lepcha* :- Tamshaprip—; *Madagascar*: Ravinbury, Vahenosy—; *Malaya*: Akar mumpanang, Gasinggasing, Gegasing—; *Malayalam*: Kattuvalli, Patuvalli—; *Marathi*: Padavali, Padavel, Pahadvel, Paharmul, Paharvel—;

Mexico: Oreja de raton—; *Mundari*: Cutulutur, Dirikakaru, Haruarajaite, Huringpitusing—; *Nepal*: Batulpoti—; *North Western Provinces*: Dakhnirbisi, Duknirbissi—; *Oudh*: Harjewri—; *Pedi*: Lepeta—; *Philippines*: Calaad, Chanchae, Sansao—; *Porebunder*: Kardhiyunbang—; *Porto Rico*: Bejuca de mono—; *Portuguese*: Abutua, Pareira brava—; *Punjab*: Bat, Batindupath, Bel, Katori, Parbik, Pataki, Tikri, Zakhmihaiyat, Zucumyeat—; *Sakalave*: Hamafana—; *Sanskrit*: Ambashtha, Ambashthika, Avidhakarni, Brihattikta, Chchinnaveshika, Devi, Ekashthila, Kuchela, Kucheli, Laghupatha, Mahanjasi, Malati, Malavi, Papacheli, Papehelika, Patha, Patika, Prachina, Prachinambastika, Pratanini, Rasa, Ruchishya, Shishira, Shreyasi, Sthapini, Sushhira, Tiktapushpa, Trishira, Trivrita, Uthika, Vallika, Vara, Varatikta, Vatsadini, Venivalli, Vidhakarni, Vridhakarnika, Vriki, Vrittaparni—; *Santal*: Tejomalla—; *Saora*: Paterutivu—; *Sind*: Belpath, Katori—; *Sinhalese*: Deyamitta, Diyamitta, Weniwela—; *Spanish*: Butua, Pareira brava—; *Subia*: Mokaekae—; *Tagalog*: Chinchaochinchauan, Gulangulamanan, Sansaosansansaosan, Yemoumohan—; *Tamil*: Appatta, Puimushti, Punaittitta, Punmushti, Puttutiruppi, Sina, Titta, Tuvan, Tuvigaba, Vattattiruppi—; *Telugu*: Adivibankatige, Pata, Visaboddi—; *Tharu*: Batulpati—; *Twi*: Aportororkungma—; *Uriya*: Okanobindhi—; *Uruguay*: Butua, Pareira brava—; *Visayan*: Hampapari, Himpapara, Pari, Sampapari—; *Yoruba*: Je-in-joko, Jo-ko-je—.

COCCULUS.

This genus consists of 11 species found in all warm countries.

C. laurifolius DC. and *C. trilobus* DC. are used medicinally in Indo-China and Malaya, *C. Thunbergii* DC. in Japan, and *C. pendulus* Diels in the Sudan and in Senegal.

I. Scandent shrubs.
  1. Leaves suborbicular, glabrous; panicles large ... 4. *C. macrocarpus.*
  2. Leaves deltoid or hastate, villous; panicles short ... 1. *C. hirsutus.*
  3. Leaves oblong or trapezoidal, at length glabrous. Male flowers fascicled, female solitary ... 2. *C. pendulus.*
II. A shrub or small tree ... ... 3. *C. laurifolius.*

1. **Cocculus hirsutus** Diels occurs in tropical and subtropical India from the foot of the Himalayas to South India and Ceylon and Pegu; it extends to Southern China, Arabia, and tropical Africa.

The root is generally used as a refrigerant, and also as a gentle laxative. It has been extensively used as an alterative in chronic rheumatic and venereal diseases.

A decoction of the fresh roots, with a few heads of pepper, in goat's milk, is administered for rheumatic and old venereal pains; half a pint every morning is the dose. It is reckoned heating, laxative, and sudorific.

In the Konkan, the roots, rubbed with Bonduc nuts, are administered as a cure for belly-ache in children. In bilious dyspepsia, they are given in 6 *massa* doses, with ginger and sugar.

In Sind, the root and leaves are used in headache and neuralgic pains.

The juice of the leaves, mixed with water, has the property of coagulating into a green jelly-like substance, which is taken internally, sweetened with sugar, as cure for gonorrhoea.

In Baluchistan the mucilage is used to cure spermatorrhoea, taken in milk; it is used for coughs and to put on to sore eyelids and to soften breasts

Arabic: Haddal, Herrije, Luah, Schirwai—; *Baluchistan*: Afaband, Zamur—; *Bengal*: Huyer—; *Bombay*: Parvel, Vasanvel—; *Canarese*: Dagadiballi, Dusariballi, Sugadiballi, Yadaniballi—; *English*: Broom Creeper, Ink Berry—;

Gujerati : Vevati, Vevdi— ; *Hansot* : Vachhana— ; *Hindi* : Chireta, Dier, Faridburti, Hier, Jalayamani, Jamtikibel— ; *Jaisalmer* : Bajarbel— ; *Konkan* : Vanatiktika— ; *Marathi* : Hunder, Parvel, Tana, Vasanavela, Vasanel, Vasanvel — ; *Matheran* : Tan, Vasanyel— ; *Nimar* : Bochan— ; *North-Western Provinces* : Patha— ; *Oudh* : Karsane— ; *Persian* : Faridbutti— ; *Porebunder* : Vadhinovelo— ; *Sanskrit* : Patalagarudi, Chchilihinda, Dirghakanda, Dirghavalli, Dridhakanda, Dridhalata, Garudi, Mahahala, Mahamula, Mochakabhida, Sauparni, Somavalli, Tiktanga, Vanatiktika, Vasandi, Vasantitikta, Vatsadani— ; *Sind* : Kursan, Zamir— ; *Tamil* : Kattukodi— ; *Telugu* : Chipurutige, Dusaritige, Katlatige— ; *Urdu* : Faridbutti— ; *Uriya* : Musakani—.

2. **Cocculus pendulus** Diels occurs in Sind, Baluchistan, Waziristan, the Punjab Plains to the Northern Circars, Kathiawar, Deccan, Carnatic to Tinnevelly. It extends through Afghanistan and Arabia to tropical and subtropical Africa.

The root is used in Sind and Afghanistan in the treatment of intermittent fevers and as a substitute for *Anamirta paniculata*. It is used by the natives in Senegal and in the French Sudan for the cure of periodic fevers.

The flowers are added to food, and an infusion of the plant is used in Senegal to assist in removing thorns from the feet.

The Arabs make an intoxicating drink from the fruits.

Heckel and Schlagdenhauffen have found in the root about 2 per cent. of pelosine, and about 3 per cent of a new crystalline alkaloid 'sangoline'. The root also contains columbin.

Arabic : Ssag-el-ghorab, Turrach— ; *Baluchi* : Zamor— ; *Brahui* : Zamor— ; *Egypt* : Lebakh-el-gebel— ; *Falor* : Tiati— ; *Gujerat* : Parwatti— ; *Jaisalmer* : Pilwan— ; *Jodhpur* : Pilwan— ; *Punjab* : Illarbillar, Parwatti, Vallur, Vehri— ; *Sind* : Ullarbillar— ; *Senegal* : Sangol— ; *Songhai* : Liligui— ; *Telugu* : Dusaratige— ; *Tukulor* : Safatou— ; *Waziri* : Jadhai, Parwatiae— ; *Wolog* : Mboum sehet, Mboum tiéré—.

3. **Cocculus laurifolius** DC. occurs in subtropical Himalaya from Nepal to Jammu up to 5,000 feet, in the Western Ghats of the Madras Presidency, Eastern Bengal, and Burma. It is distributed to South Cochin-China, South China, Java, Formosa, and Japan.

The jungle tribes of the Malay Peninsula use the plant to poison their arrows and darts.

China : Wu Yao— ; *Dehra Dun* : Tildhara, Tilphara— ; *Garhwal* : Tildhara— ; *Japan* : Kansirowujak, Vjaku, Wujak— ; *North-Western Provinces* : Tilphara—.

4. **Cocculus macrocarpus** W. and A. is found in the Konkan, North Kanara, the South Mahratta Country, and China.

The powdered leaves are taken in milk as a cure for biliousness, gonorrhoea, and syphilis.

Matheran : Vatoli, Wat-yel, Watan-yel— ; *Tamil* : Kottaiyachachi—.

COSCINIUM.

The genus consists of 6 Indo-Malayan species.

Coscinium fenestratum Colebr. occurs in South India and Ceylon, extending to Sumatra.

The root is extensively used in Ceylon as an efficient bitter tonic, and is viewed as a very good substitute for Columba. It has also antiseptic properties to a great extent, and can be used for dressing wounds and ulcers.

The wood is valued as a bitter tonic by the Sinhalese. It is also much used as a cure for tetanus.

A decoction of the stem is given internally in cases of bites from monkeys, snakes, brahmin-lizards and geckos. Mhaskar and Caius have found experimentally that the stem is not an antidote to snake venom, whether colubrine or viperine.

The decoction of the bark was administered in doses of one to two ounces three times a day to several patients suffering from malarial fever, but no beneficial effects were noticed (Koman).

The plant is used by the Sakais in the preparation of their dart poisons.

Tummin Katti and Shintre (1930) have analysed the alcoholic extract of the stems and they have reported *inter alia* a considerable amount of a mixture of alkaloids.

Bengal : Haldigach—; *Canarese* : Doddamaradarasina, Maradarashina, Maramanjali—; *Deccan* : Jhadihaladi, Jharkihaldi—; *English* : Calumba Wood, Ceylon Calumba Root, Columbo Wood, False Columbo, Tree Turmeric—; *Malay* : Akar kunyit, Kunyit babi—; *Malayalam* : Haridram, Maramannal—; *Marathi* : Venivel—; *Sakai* : Tol—; *Sanskrit* : Daruharidra, Darvi, Pitadru—; *Sinhâlese* : Bangwellgetta, Venivel, Woniwol—; *Tamil* : Atturam, Imalam, Kadari, Manjalkodi, Maramanjal, Pasamantram, Sanniyam, Seyebasam, Tiyaram, Udaravi, Udubadi—; *Telugu* : Manupasupu—; *Tulu* : Maramanjali—.

FIBRAUREA.

The genus consists of 4 species found in tropical and subtropical Asia.

Fibraurea chloroleuca Miers is very common in hedges and woods from Singapore to Penang. It extends to Tavoy and to the Malay Islands and Celebes.

The plant is used medicinally in Cochin-China and in the Malay Peninsula.

The root is used as a diuretic. The bitter stem is considered a valuable tonic, and is given in intermittent fevers and hepatic troubles.

Indo-China : Day vang giang—; *Malay* : Akar kinching kerbau, Akar kuning—.

JATRORRHIZA.

The genus consists of 2 species, natives of tropical Africa.

J. strigosa Miers is used medicinally by the Bakwiri and others in Cameroon.

Jatrorrhiza palmata Miers is cultivated in some parts of India.

The root is much used in Zambezi, Mozambique, Madagascar, and Indo-China as a bitter tonic and stomachic. By the natives of Mozambique it is used in dysentery and various other diseases.

It is a mild bitter free from astringency. It is useful in functional atonic conditions of the digestive organs, especially with other tonics, aromatics, or cathartics.

The root contains three physiologically active bases : columbamin, jateorhizin, and palmatin.

J. palmata Miers. is official in all pharmacopoeias. The difference in botanical origin is merely one of synonymy; and there is considerable confusion in the spelling of both the generic and specific names.

Austria: Kalumba—; *Belgium*: Colombo—; *Bombay*: Colombo—; *Brazil*: Calumba—; *Denmark*: Kolumbo—; *England*: Calumba, Colombo—; *Finland*: Kolumbo—; *France*: Colombo—; *Germany*: Kolombo—; *Holland*: Calumba—; *Hungary*: Calumba—; *Indo-China*: Phong Ky—; *Italy*: Colombo—; *Japan*: Calumba—; *Mexico*: Columbo—; *Norway*: Kolumbo—; *Portugal*: Calumba—; *Russia*: Kolombo—; *Spain*: Colombo—; *Sweden*: Kalumba—; *Switzerland*: Colombo—; *Tamil*: Kolumbu—; *Telugu*: Kalamba—; *Turkey*: Guvercin, Kalumba—; *United States*: Calumb, Calumba, Columbo—; *Uriya*: Kolombo—.

PACHYGONE.

This genus consists of 11 Indo-Malayan species.

Pachygone ovata Miers inhabits South India and Ceylon.

The dried fruit is used to destroy vermin and to stupefy fish.

Burma: Ngupyu—; *Ceylon*: Kadukkodi—; *Tamil*: Kadukkodi—.

PERICAMPYLUS.

This genus consists of 6 Indo-Malayan species.

Pericampylus glaucus Blatter occurs in Sikkim, Khasia, Assam, Pegu, Martaban, Tenasserim, Mergui, Chittagong, the Nicobars, and the Malay Peninsula. It extends to the Malay Archipelago, eastwards to the Moluccas, Cochin-China, Laos, Tongking, South China and Formosa.

The roots have long been held in great repute among snake-charmers in India as an antidote to the bites of poisonous snakes; but Mhaskar and Caius have shown that they are not an antidote to snake venom.

Bengal: Barakkanta—; *Cochin-China*: Day loi tien—; *Java*: Aroygeureung —; *Nepal*: Lahara, Pipalpati—; *Sumatra*: Currung—.

STEPHANIA.

The genus numbers 32 species, found in the Old World, chiefly in tropical Africa, China, and the Malayan Islands.

S. abyssinica Walp. and *S. Dinklagei* Diels are used medicinally in Yorula, Liberia and Sierra Leone.

1. Leaves ovate or subdeltoid, peltate ... ... *S. hernandifolia.*
2. Leaves broadly ovate or suborbicular, at the base rotund ... ... *S. glabra.*

1. **Stephania hernandifolia** Walp. is found on the western and eastern coasts of the Indian Peninsula, in Cachar, Sikkim, Eastern Bengal, Assam, and Penang; it is distributed over Siam and the Malay Archipelago to Australia.

The bitter root enters into the composition of a good many Ayurveda preparations as a substitute for that of *Cissampelos Pareira* Linn.

It is regarded as bitter, astringent, easily digestible and useful in fever, diarrhoea, urinary diseases, dyspepsia, etc.

The extract acts as a strong poison on frogs (Bancroft).

Bengal: Agnadnemuka, Akanadi—; *Burma*: Sha ma say nway—; *China*: Chien Chin T'eng—; *Hindi*: Akanadi—; *Java*: Areujgeureung, Ojotminjak—; *Malayalam*: Patakilannu, Patavalli—; *Mundari*: Marangpitusing—; *Nepal*: Tambarki—; *Sadani*: Gaipari—; *Sanskrit*: Ambashtha, Patha, Vanatiktika—; *Saora*: Duvgyatige—; *Sinhalese*: Lunuketigawel, Lupuketigawel—; *Uriya*: Musakani, Nimukha, Okanobhindi, Sondhimali—; *Zulu*: umTambane—.

2. **Stephania glabra** Roxb. occurs in the Himalaya from Simla to Sikkim, in the Khasia Hills, Assam, and Tenasserim.

Roxburgh states that the acrid root is used medicinally in Sylhet.

In Cochin-China it is used in pulmonary tuberculosis, asthma, dysentery, and fever.

Annam: Cu binh voi, Cu mot, Tu nhien—; *Dehra Dun*: Parah, Purha—; *Garhwal*: Gindaru—; *Nepal*: Brakulilahara, Nimilahara, Tambarki—; *Tongking*: Day moi tron—.

TILIACORA.

The genus includes 15 species, which inhabit India and tropical Africa.

Tiliacora acuminata Miers occurs from Bengal to Orissa and Konkan, Ceylon, Singapore, Java, and Cochin-China.

The root rubbed between stones and mixed with water, is given as a drink for the cure of venomous snake-bites; but, according to Mhaskar and Caius, the root is not an antidote to snake venom.

Bengal: Tiliakora, Tiliakoru—; *Canarese*: Kuri—; *Hindi*: Bagamushada, Karraath, Karwanth, Rangoe—; *Malayalam*: Vallikkanniram—; *Oudh*: Karwanth, Rangoe—; *Telugu*: Kappatige, Nagamushini, Nallatige, Pataveru, Tigemushidi, Vettichitramulamu—; *Uriya*: Ralajati noi, Kolichiti—.

TINOMISCIUM.

This genus consists of 8 Malayan species.

Tinomiscium petiolare Miers is very common in forests and secondary jungle, along roadsides, etc., from Singapore to Kedah. It is distributed to Tongking, Sumatra, and Borneo.

The Malays use the plant as a drug in rheumatism.

Malay: Akar langkap, Akar lempoyang, Akar lumpang, Akar mumbulu, Akar nasi—.

TINOSPORA.

The genus numbers 40 species distributed over most of the palaeotropical regions, but chiefly in Indo-Malaya.

The following species are used medicinally in Senegal—*T. bakis* Miers.—; in Indo-China—*T. cordifolia* Miers., *T. crispa* Miers., *T. malabarica* Miers.—; in the Philippine Islands—*T. crispa* Miers.—; in Java—*T. Rumphii* Boerl.—.

I. Endocarp distinctly tuberculate
  1. Leaves pilose on both sides or at least beneath ... 1. *T. malabarica*.
  2. Leaves glabrous ... ... 2. *T. crispa*.
II. Endocarp rotund-ovoid, ribbed on the back, otherwise almost smooth ... ... 3. *T. cordifolia*.

1. **Tinospora malabarica** Miers is found in Bengal, Khasia, Assam, Orissa, Konkan, Kanara, nearly all the districts of the Madras Presidency, and Ceylon.

The plant has tonic properties.

In China and Tongking the fresh leaves and the stem are used in the treatment of chronic rheumatism.

The whole plant is used medicinally in Cambodia. Fumigations are recommended for piles and ulcerated wounds. Medicated baths are prepared in cases of liver complaint.

Almora: Gureh—; *Annam*: Khoan can dang—; *Bengal*: Bara padmagulancha, Padmagaluncha—; *Cambodia*: Kambaur—; *Ceylon*: Bukinda, Walkinda—; *Garhwal*: Gileh—; *Hindi*: Giloe, Gulancha, Gureh—; *Malaya*: Bara sarasati lat—; *Marathi*: Gulvel—; *Ramnagar*: Gurja—; *Sinhalese*: Bukinda—; *Tamil*: Potchindil—; *Tongking*: Day dan xuong—; *Uriya*: Guduchi, Gulochi, Podmogulochi—.

2. **Tinospora crispa** Miers occurs in Sylhet, Assam, and Burma. It is cultivated in the Malay Peninsula and Ceylon. It is found throughout the Malay Archipelago.

The whole plant is exceedingly bitter, and is employed by the Malays in the cure of intermittent fevers.

In Indo-China the stem is considered a febrifuge of great importance. As a tonic it is said to give as good results as quinine. There is a widespread opinion that it is an excellent tonic during convalescence from exhausting diseases.

In the Philippine Islands it is considered to be a panacea to be applied to all bodily afflictions. It is given in general debility, in chronic rheumatism, in malarial fevers.

The jungle tribes of the Malay Peninsula use the plant in the preparation of their arrow and dart poisons.

Annam: Day Ki nin, Day than thong—; *Cambodia*: Bandaul pech, Bora phet—; *French*: Liane-quinine—; *Malay*: Toba, Tuba, Tubabidyi—; *Sinhalese*: Tithakinda, Tittakinda—; *Sunda Islands*: Andawali—; *Tagalog*: Macabuhai—; *Tongking*: Thuoc sot ret—; *Visayan*: Paliavan, Panavan, Pangiavan—. The Indian names are the same as for *T. cordifolia*.

3. **Tinospora cordifolia** Miers is found throughout tropical India, Burma, the Andamans, and Ceylon.

The stem is one of the most popular drugs in India, being held in high repute by Ayurveda and Yunani doctors alike.

The stem is a bitter stomachic; stimulates bile secretion; causes constipation; tonic; allays thirst, fever, burning sensation, vomiting; diuretic; enriches the blood; cures jaundice; useful in skin diseases; the juice is useful in diabetes, vaginal and urethral discharges, low fevers, and enlarged spleen (Ayurveda).

Stem bitter; appetiser, stomachic, tonic, antipyretic, expectorant; good in cough, jaundice, giddiness, vomiting, piles, anaemia, chronic fever; renews the blood; mixed with sesame oil it is useful for massaging the body (Yunani).

An infusion of the powdered stem is used as an alterative and tonic, and has enjoyed the reputation among ancient Hindu writers of being an aphrodisiac.

In Ceylon the stem is used in fevers, skin diseases, jaundice, and syphilis. A decoction of the stem is given internally, and the bruised fresh leaves are applied externally for the bites of flies and the sting of bees.

The starch obtained from the roots and stems of the plant is similar to Arrow-root in appearance and effect. It answers not only as a remedial medicinal agent in chronic diarrhoea and some forms of obstinate chronic dysentery, but it is also a valuable nutrient, when there is intestinal irritability and inability to digest any kind of food. I have myself had experience of the usefulness of this starch. I think that this drug is useful where there is an acid diarrhoea, due to an acidity of the intestinal canal or acid dyspepsia. It is useful in relieving the symptoms of rheumatism. There is another preparation of this plant, the *succus* (juice), freshly prepared from the fresh plant. It acts as a powerful diuretic. It is prescribed by ancient Hindu physicians in gonorrhoea with advantage (Kirtikar).

The Mundas of Chota Nagpur apply the ground plant on fractures.

In certain parts of India the plant is regarded as a specific for the bites of poisonous insects and venomous snakes. The juice and decoction of the root are applied to the part bitten, poured frequently into the eyes and administered internally by mouth at intervals of half an hour.

The majority of Sanskrit authors prescribe the root and stem in combination with other drugs as an antidote to snake-bite and scorpion-sting. Mhaskar and Caius have, however, shown experimentally that the root and stem are useless in the antidotal treatment of snake-bite; the root is also useless as a collyrium or as an external application to the bitten part; the root is equally useless in the treatment of scorpion-sting.

A tincture was tried in mild cases of malaria and was found to be useless in such cases. The aqueous extract was tried in the low chronic fever of kala-azar and also in diabetes, but it was not found to possess the virtues attributed to it. . . . The drug was given, another fair trial in the form of a liquid extract in several cases of malarial fever, both in children and adults. Its action was found to be very slow. The drug had to be administered for several days before even mild cases were cured. In chronic cases it did not do any good, although it is a reputed medicine in the Hindu Pharmacopoeia for all fevers (Koman).

Arabic: Gilo—; *Bengal*: Gadancha, Giloe, Gulancha, Guluncha, Gunchi, Nimgilo—; *Bombay*: Ambarvel, Gharol, Giroli, Guloe, Gulwel—; *Burma*: Singomone, Sinzamanne—; *Canarese*: Amrytaballi, Madhuparne, Uganiballi—; *Cantonese*: Fun khu hang—; *Central Provinces*: Gulwel—; *Ceylon*: Chintil—; *Chinese*: K'uan Chu Hsing—; *Deccan*: Gulbel, Gulo, Gulvel—; *French*: Culancha—; *Goa*: Amritvel, Amrityel—; *Gujerati,* Gado, Galo, Gulo, Gulwel—; *Hansot*: Galavel—; *Hindi*: Giloe, Gulancha, Gulbel, Gulel, Guloh, Gurach, Gurcha—; *Indo-China*: Day than thong—; *Kathiawar*: Galo, Galonowelo—; *Khond*: Gursilai—; *Konkani*: Amontevel, Ekoiss givanem—; *Kumaon*: Gulancha, Gurcha—; *Lepcha*: Kantherrik—; *Malaya*: Foon kan thang, Sarasati lat—; *Malayalam*: Amrytu, Peyamrytam, Sittamrytu—; *Marathi*: Ambarvel, Gharol, Giroli, Gulavela, Gulaveli, Guloe, Gulvel—; *Mundari*: Harajora, Harajuri, Harjora—; *Nepal*: Garjo—; *Persian*: Gulbel—; *Punjab*: Batindu, Garham, Garum, Gilo, Gilogularich, Zakhmihaiyat—; *Reddi*: Korapattatige—; *Sadani*: Harjora—; *Sanskrit*: Amrita, Amritalata, Amritavallari, Amritavalli, Bhishakapriya, Chakralakshana, Chakrangi, Chandrahasa, Chandrapasa, Chchinna, Chchinnaruha, Chchinnodbava, Chchinnodhana, Dhira, Goraksha, Guduchi, Guluchi, Jivanthika, Jivantiha, Jwaranashini, Jwarari, Kundalini, Kundalli, Madhuparni, Madhuparnika, Nagakumarika, Nirjara, Pamrodhara, Pittaghni, Rasayani, Shyama, Somalatika, Somavalli, Surakrita, Tantri, Tantrika, Uddhara, Vara, Vataraktari, Vatsadani, Vayastha, Vishalya—; *Sikkim*: Gurjo—; *Sinhalese*: Galuchi, Rasakinda, Rassakinda—; *Tamil*: Amridavalli, Amudam, Asasi, Kaippuchindil, Kunali, Narsindil, Niraidarudian, Paganrai, Padalamulam, Parivai, Pattigai, Sadi, Sagadundam, Sagamuli, Silam, Sindil, Sivandi, Sivedai, Ubavam, Vallikkandam, Vayamadu—; *Telugu*: Duyutige, Guduchi, Iruluchi, Jivantika, Madhuka, Manapala, Somida, Tellatippatige, Tippatige—; *Tharu*: Gulach—; *Tulu*: Amrytaburu—; *Uriya*: Gulancha, Gulochi—.

V.

The BERBERIDACEÆ are glabrous herbs or shrubs, sometimes climbing. They number 200 species included in 12 genera. They grow in the temperate regions of the northern hemispheres, in tropical mountains, in the Andes and extra-tropical South America. They are absent from tropical and South Africa, Australia and New Zealand.

The medicinal and poisonous Berberids of the world belong to 10 genera:—ACHLYS (Japan; Pacific North America); BERBERIS (Northern hemisphere; South America); BONGARDIA (Eastern Mediterranean); CAULOPHYLLUM (North-eastern Asia; North-America); DIPHYLLEIA (Atlantic North America; Japan); EPIMEDIUM (northern temperate regions); LEONTICE (northern temperate regions); MAHONIA (southern hemisphere; cultivated); NANDINA (China, Japan); PODOPHYLLUM (northern temperate regions).

In general the root and bark are purgative; the bitter bark is tonic and antiperiodic or depurative and cooling; the sour fruit is astringent and antiscorbutic.

The following are among the products isolated:— (1) *alkaloids*—berbamine, berberine, oxyacanthine—; (2) *resins*—podophylloresin, podophyllotoxin—; (3) *colouring matter*—podophylloquercetin—; (4) *acids*—malic, citric—.

The medicinal and poisonous Berberids of India belong to 4 genera—BERBERIS, BONGARDIA, MAHONIA, PODOPHYLLUM.

A. Stem 0 or erect. Flowers hermaphrodite. Carpel 1. Seeds usually small	
I. Leaves unequally pinnate. Leaflets opposite ...	MAHONIA.
II. Leaves simple, fascicled in the axils of 3-5-partite, rarely simple spines	BERBERIS.
III. Leaves simple, palmate. Ovules many	PODOPHYLLUM.
B. Glabrous herb with tuberous root. All the leaves radical	BONGARDIA.

BERBERIS.

This genus includes 190 species inhabiting the northern hemisphere, and South America.

About forty species of *Berberis* are used medicinally, and they all seem to have similar therapeutical properties. Their stems and barks are bitter tonics and mild laxatives.

There are three well-defined medicinal groups:—(1) The Rocky Mountain group, including *B. aquifolium* Pursh.; (2) the Asiatic group, which includes *B. aristata* DC.; (3) the European group, which includes *B. vulgaris* Linn.

The following deserve special mention in Europe—*B. aetnensis* Presl., *B. vulgaris* Linn.—; in China—*B. Sieboldii* Miq., *B. vulgaris* Linn.—; in Indo-China—*B. asiatica* Roxb., *B. Lycium* Royle, *B. japonica* R. Br., *B. vulgaris* Linn.—; in North America—*B. aquifolium* Pursh., *B. nervosa* Pursh., *B. pinnata* Lag., *B. valgaris* Linn.—; in Central America—*B. trifoliatus* Moric.—; in Colombia—*B. glauca* DC.—.

Berberine has been isolated from *B. aetnensis, B. aquifolium, B. buxifolia, B. glauca, B. nervosa, B. vulgaris.* Berbamine and oxyacanthine are contained in the root barks of *B. aquifolium* and *B. vulgaris.*

A. Ripe fruit red. Inflorescence a simple raceme. Leaves usually toothed, lower pedicels 8-25 mm. long ...1. *B. vulgaris.*
B. Ripe fruit blue black. Inflorescence a simple raceme
  1. Leaves glossy green not glaucous beneath ... 2. *B. aristata.*
  2. Leaves pale glaucous beneath
    a. Leaves 1.3-3.8 cm. broad, secondary nerves prominent above ... ... 4. *B. asiatica.*
    b. Leaves 7.5-18 mm. broad, secondary nerves not prominent above ... ... 3. *B. lycium.*

1. **Berberis vulgaris** Linn. is found in the Western Himalaya from Kashmir to Nepal up to 12,000 feet. It also occurs in Western Tibet, and is generally distributed over temperate Asia and the greater part of Europe and Northern Africa.

The root-bark and the stem-bark have the same composition and possess the same medicinal properties.

Barberry bark is tonic, purgative, and antiseptic. As a bitter stomachic tonic, it proves an excellent remedy for dyspepsia and functional derangement of the liver, regulating the digestive powers, and if given in larger doses, acting as a mild purgative and removing constipation.

The bark is used for all cases of jaundice, general debility and biliousness, and for diarrhoea. It possesses febrifuge powers and is used as a remedy for intermittent fevers. It also forms an excellent gargle for a sore mouth. A good lotion for application to cutaneous eruptions has also been made from it.

In the Punjab, the root bark is used as diuretic, and for the relief of heat, thirst and nausea. It is considered astringent, refrigerant and antibilious. In small doses it is tonic, in larger cathartic. In the form of decoction, it is useful in scarlet fever and brain affections.

In Baluchistan the roots are boiled in water and the decoction given both to men and cattle for internal injuries. It is said to be good for fever, especially high fever.

On the Pacific Coast of North America the root-bark is considered tonic and aperient; the leaves are used as an antiscorbutic.

The berries are official in France. They contain citric and malic acids, and possess astringent and antiscorbutic properties. They are useful in inflammatory fevers, especially typhus, also in bilious disorders and scurvy; and in the form of a jelly they are very refreshing in irritable sore throat, for which also a Syrup of Barberries made with water, proves an excellent astringent gargle.

In England the fruits are macerated in about twelve times their quantity of water, to which a little fennel seed has been added, and the liquid is used as a cooling draught in cases of fever.

The Egyptians are said still to employ a diluted juice of the berries in pestilential fevers. In Ceylon the ripe fruits are used in the preparation of cooling, astringent, and antiscorbutic drinks which are given in febrile diseases and diarrhoea.

In Persia the consumption of the berries is said to remove itch and other skin complaints.

Arabic: Ambarbaris, Ambar-us-shahab—; *Baluchi*: Karoskae, Korae, Zrolg—; *Bombay*: Zarishk—; *Brahui*: Zarch—; *Catalan*: Coralets—; *Dutch*: Barbarine, Berberis, Kweekdorn, Zuurdoorn—; *English*: Barbaryn, Barberry, Barboranne, Berber, Berberry, Guild, Jaundice Berry, Maiden Barberry, Pepperridge, Piperidge, Piperidge Bush, Piperidge Rilts, Pipperidge-bush, Piprage, Woodsore, Woodsour, Woodsower Tree—; *French*: Berbéris, Chivafou, Epine-aigrette, Epine-vinette, Verre-vinette, Vinette, Vinettier—; *German* Basselbeere Berberitze, Berberstrauch, Bramelbeere, Bromelbeere, Dreidorn, Erbselbeere, Erbsele, Essigdorn, Farsbeere, Gallhageldorn, Gelbbeere, Passelbeere, Peiselbeere, Reifbeere, Reisbeere, Reissbeere, Reisselbeere, Rhabarberbeere, Sauch, Sauerdorn, Sauerrach, Saurach, Spitzbeere, Versuchsbeere, Weinaengleinstrauch, Weinling, Weinnaegelein, Weinshade, Weinschaerl, Weinzaepfel, Wuetscherling, Zwackholzbaum—; *Greek*: Axokanda—; *Hamadan*: Zirishk—; *Hattu*: Chamchur, Chochar—; *Hindi*: Zarishk—; *Italian*: Berberi, Berbero, Crespigno, Crespino, Spina santa, Trespino—; *Jaunsar*: Chatrod—; *Pacific Coast*: Barberry, Common Barberry, European Barberry, Garden Barberry, Guild-tree, Jaundice-berry, Sowberry, Wood-sour—; *Persian*: Bedana, Cutch, Karoskai, Zarishk—; *Portuguese*: Berberis—; *Punjab*: Chachar, Chochar, Kashmal, Zirishk—; *Pushtu*: Karoskai—; *Roumanian*: Dracila, Lemn galben, Macris de riuri—; *Russian*: Barbaris—; *Sibi*: Karoskae, Zrolg—; *Spanish*: Acetin, Agracejo, Agracillo, Agraz, Agrecillo, Alarguez, Alguese, Azlacristo, Berberos—; *Toba Hills*: Karoskae, Zrolg—; *Urdu*: Ambar—; *Zarghun*: Karoskae, Zrolg—; *Zhob*: Korae, Zrolg—.

2. **Berberis aristata** DC. occurs in the Himalaya from Chota Banghal to Nepal, between 6,000 and 10,500 feet.

The wood, root-bark and extract of Indian Barberry have been used in Hindoo Medicine from a very remote period. Its properties are said to be analogous to those of turmeric. Indian Barberry and its extract, *rasot*, are regarded as alterative and deobstruent, and are used in skin diseases, menorrhagia, diarrhoea, jaundice, and above all in affections of the eyes. Sarangdhara recommends a simple decoction of Indian barberry to be given, with the addition of honey in jaundice. In painful micturition from bilious or acrid urine, a decoction of Indian barberry and emblic myrobalan is given with honey. A decoction of the root-bark is used as a wash for unhealthy ulcers, and is said to improve their appearance and promote cicatrization. *Rasot*, mixed with honey, is said to be a useful application to aphthous sores.

A decoction of the root bark in doses of one to two ounces was given to several patients for malarial fever and was found to be beneficial, the effect being very slow (Koman).

Arabic: Aargis, Ambarbaris, Hhodhub, Itrarahh, Messuk—; *Bagi*: Chochar, Kambra, Tharmala—; *Bhutia*: Tsema—; *Canarese*: Bagisutra—; *English*: Indian Barberry, Tree Turmeric—; *Garhwal*: Kingora—; *Greek*: Lykion indikon—; *Hindi*: Chitra, Chotra, Darhald, Hooshish, Kashmal, Kashmar, Rasvat, Rusot—; *Jaunsar*: Kashmoi—; *Malayalam*: Maradarisina, Maramanjal—; *Narkand*: Chochar, Kambra, Tharmala—; *Nepal*: Chitra, Chutro—; *North-Western Provinces*: Chitra—; *Persian*: Chitra; Zirishk—; *Punjab*: Chitra, Kasmal, Kemloo, Simlu, Sumlu, Tutrum—; *Sanskrit*: Daruharidra, Darvi, Kata, Katankati, Kateri, Pitadaru, Suvarnavarna—; *Simla*: Kammul, Kashmal, Kaumul—; *Tamil*: Mullukala, Usikkala—.

3. **Berberis lycium** Royle is found in the Punjab Himalaya between 3,000 and 9,000 feet, and in Kumaon at 2,500-8,500 feet.

The root is highly esteemed as a febrifuge and as a local application in eye diseases.

An extract prepared by digesting in water sliced pieces of the root, stem, and branches, is called *rusot*, and is used advantageously in cases of ophthalmia.

The leaves are administered in Baluchistan as a cure for jaundice.

In Indo-China the fruit is given as a tonic in troubles of the kidney.

The tincture was found to be useless as a remedial agent in fevers of malarial origin (Central Indigenous Drugs Committee).

Arabic: Ambarbarin, Hooziz, Hoozizindi—; *Baluchistan*: Koroski, Zarch—; *Cutch*: Kasmal—; *Hindi*: Chitra, Kushmul—; *Indo-China*: Cau tu, Ky tu—; *Jaunsar*: Chahoi, Daruhaldli, Kashmal—; *North-Western Provinces*: Kushmul—; *Persian*: Unjebar—; *Simla*: Chochar, Chotra, Kashmal, Kasmal—; *Sind*: Kushmul—; *Waziri*: Khadavanai, Sakazie, Sarghazie—.

4. **Berberis asiatica** Roxb. is found in the dry valleys of the Himalaya, from Garhwal to Bhutan, between 2,000 and 8,000 feet. It also occurs in Bihar, Mount Abu, and Afghanistan.

The plant is used for the same purpose and in the same ways as *B. aristata*. It is reputed useful in the treatment of snake-bite and scorpion-sting; but Mhaskar and Caius have shown the root, stem, and gum are all equally useless for the purpose.

Almora: Kilmoru—; *Bengal*: Daruharitra—; *Canarese*: Maradarisina—; *Dehra Dun*: Kingora—; *Garhwal*: Kingora—; *Gujerat*: Daruhaldar—; *Hindi*: Daruhaldi, Sumlu—; *Jaunsar*: Kishornoi—; *Kumaon*: Kilmora, Kilmoru—; *Marathi*: Daruhaldi—; *Nepal*: Chitra, Kissie, Matekissie—; *Persian*: Darhuld, Daruhuld—; *Ranikhet*: Kilmoru—; *Sanskrit*: Daruharidra, Darupita, Darunisha, Darvi, Dvitiyabha, Haimavati, Haridra, Hemakanti, Hemkranta, Kaliyaka, Kamini, Kapitaka, Karkatini, Karnavati, Kashtha, Kashtharajani, Katankateri, Marnmari, Nirdishta, Pachampacha, Parjani, Parjaniya, Pita, Pitachandana, Pitadaru, Pitadru, Pitatvaka, Pitika, Sthirraga—; *Simla*: Kammula, Kashmala, Kaumula—.

BONGARDIA.

B. Rauwolfii C. A. Mey. The only species of this genus occurs in Baluchistan, whence it spreads to Afghanistan, Persia, Transcaucasus, Syria, Palestine, Bithynia, and the Greek Islands.

In Baluchistan the leaves are used as a cure for sore eyes in horses.

Ghandoba: Puccatutuka—; *Kotra*: Shrin—.

MAHONIA.

This genus includes 50 species, which inhabit the southern hemisphere. Many are cultivated as ornamental shrubs.

In North America the berries of *M. fascicularis* DC. are considered a cooling laxative medicine.

Mahonia napaulensis DC. is found in the temperate Himalaya at 4,000-8,000 feet, from Garhwal to Bhutan; in the Khasia Hills between 4,000 and 5,000 feet; in Mergui; and in the Nilgiri mountains between 5,000 and 8,000 feet.

The berries are considered diuretic, and demulcent in dysentery.

Chamba: Kandlu, Sharor—; *Garhwal*: Gurm, Haldia—; *Jaunsar*: Khoru—; *Nepal*: Chatri, Jamnemunola, Milkissie—; *Punjab*: Amudanda, Chiror—; *Ramnagar*: Bankhilmana—; *Travancore*: Maranthu—.

PODOPHYLLUM.

The genus consists of 5 species distributed over the northern temperate regions.

The rhizome of and resin from *P. emodi* Wall. are official in Great Britain; the dried rhizome and roots of *P. peltatum* Linn. are officially recognized in Belgium, Brazil, Denmark, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, United States; the resin from *P. peltatum* Linn. in Austria, Finland, Hungary and Yugoslavia.

Podophyllum emodi Wall. is found in the interior ranges of the Himalaya from Hazara and Kashmir to Sikkim.

The constituents of the Indian podophyllum and of the American podophyllum (*P. peltatum* Linn.) are identical. The chief constituent is podophyllotoxin. An uncrystallizable resin, podophylloresin, has also been isolated.

The drug was administered in the form of a tincture to six cases and was found to possess all the properties that the podophyllin of the British Pharmacopoeia possessed. It acts as a hepatic stimulant and cholagogue purgative (Koman).

Gujerat: Venivel—; *Hindi*: Bakrachimyaka, Bhavanbakra, Papra, Papri, Nibishi, Pilijati—; *Kashmir*: Banwangan—; *Marathi*: Podwel, Patvel—; *Punjab*: Banbakri, Bankakra, Bankakri, Chimyaka, Chyakri, Gulkakri, Gulkakru, Kakra, Papri, Wanwangan—.

OBSERVATIONS ON THE BIONOMICS OF *PANCHAX LINEATUS* CUVIER AND VALENCIENNES, WITH SPECIAL REFERENCE TO ITS LARVICIDAL PROPENSITIES.

BY

A. G. FRASER, I.M.D.

The opportunity of making the following observations was provided by Mr. Adams who showed the writer a pool near Poona containing a large number of specimens of the 'Top-Minnow' *Panchax lineatus* Cuv. & Val. The local Hindi name of the fish is *Konkani garah.* It can be readily distinguished from the other local fishes by the possession of a silver star mark on the head. The pool referred to above is situated on the south bank of the Mutha-Mulla river and, at the time of our visit, contained specimens of *P. lineatus* only, though from the end of the channel connecting the pool with the river a young *Ophicephalus* was also obtained. The paucity of the fish-fauna of the pool was probably due to the fact that it was at the time stagnant and very foul with evidence of sulphuretted hydrogen emanations. There was a heavy scum on the greater portion of its surface with fragments of floating algae. The pool was about 15 feet in diameter with an average depth of 18 inches. The bed was practically rocky throughout and grown with algae; some portions of the bank and the bed at the edges were overgrown with long grasses and weeds.

Field observations show that *Panchax lineatus* has the habit of lying for hours on end nearly flat with the surface film. When disturbed it dives below, and after 4 to 5 minutes reappears again to resume its position at the surface. Dorsally in a line with and behind the eyes there is a bright silver shield—shaped somewhat like the letter **I** in very thick type—the lustre of which when viewed from the bank and also in the aquarium is very striking. Owing to the sheen on this silver patch one is able to spot these fishes in the clearer portions of the pool almost at once, especially if the sun is shining when the scintillation produced by it is very noticeable. In the aquarium, when the fish were placed in a very dark corner of the room, the silver shield faded away and was replaced by a black or greatly dulled blotch; and at times, when there was a dim light streaming into the room, the lustre of the shield waxed and waned. When exposed to the glare of sunlight, or in the light of a dull day when clouds hide the sun, the lustre of the shield is always bright. The more light, the brighter does the sheen and scintillation become and the fishes themselves tend to turn towards the source from which the light is falling. Fishermen tell me that this species lies at the surface and waits for insects to fly over, when it leaps out for them. I was unable to confirm their statement as during my visits to the pool there was no ocular evidence of this habit. Owing to my observations having been made during the rainy season when the skies are overcast with clouds, and also because of an absence of small insects—large red and blue dragon flies were numerous and disturbed the fishes by darting down on the surface of the water—the fish, in the matter of insect food, were perhaps at a seasonal disadvantage.

The habitat of *Konkani garah* and the evidence of fishermen indicate that it is probably an insectivorous fish. Mr. Adams informs me that he has never at any time of the year been able to find larvae of mosquitoes in the pool from which the fishes were recovered. I can certainly say there were no larvae present in this pool at the time of my four visits within a period of a fortnight during June-July, 1937.

In the aquarium, as in the pool, the fishes lie flat on the surface film, particularly if the water is foul. The same foul water from the pool was used to keep a batch of 6 fishes, and 6 others were kept in a receptacle containing clear tap water.[1] One fish in the clear water receptacle died after 24 hours, but five others lived on without showing any ill effects. They only occasionally rose to the surface, but remained most of the time below in mid-water; and even in this situation the silver shield on the head remained bright as long as the fishes were directly exposed to light. When kept in a dark corner of the room the lustre of the shield gradually faded to black. On the other hand, those kept in foul water with green algae in it, remained the whole time —night and day—at the surface film, practically motionless except for a slight wriggle of the caudal and pectoral fins and with them also the shield shone brightly when in the light. The position of the fish at the surface film is such that they lie almost flat with it. The head with the silver shield is under water, but the dorsal ridge from this point backwards is flush with the surface right up to the caudal fin which is below the water line. The dorsal fin near to the caudal fin is partly above the water level. The fish will remain thus for hours unless disturbed. It should be noted that the mouth is only imperceptibly opened in the act of breathing and that the gill covers are seen to move very slightly as the respiratory rate is very slow. Some fishes leaped out of the receptacle and it was then noticed that the silver shield became black and remained so as long as the fishes were out of the water. As a matter of interest, I kept three of these fishes in a wet handkerchief and observed them from time to time and at the end of 6 hours all were alive and during the whole period they remained in a form of suspended animation with the shield showing up dulled and dark. There was no evidence of any respiratory movement or gasping for air as in the case of other surface fishes when out of water. They only wriggled or jumped if touched. One was restored to water and it recovered in ten minutes. The other two died after $6\frac{3}{4}$ hours and, only in the final stages of death, showed respiratory embarrassment by opening their mouths and muscularly exerting the gill covers. After death the colour tones became much darker. Another physical presentation is that the body is semi-transparent; the vertebral column is visibly defined as a dark shadow, so also are the stomach and the lungs, but the swim bladder is not seen as is the case with the glass-perch *Ambassis ranga*. A curious fact is that the fish, which died after a stay of 24 hours in clear water, showed the silver head shield still fairly bright; this has not yet faded in preservative up to now—a period of about one month—it is quite white but without the sheen observed in the living fish. The two fishes which were kept in a wet handkerchief and died after $6\frac{3}{4}$ hours also show a subdued discoloured patch. In all the others which had to be killed in preservative the shields have become black.

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[1] Tap water should usually be allowed to mature for at least 48 hours before it is used for aquarium purposes.—*S. L. H.*

The significance of the phenomenon observed in connection with the silver shield is at this stage very difficult to explain. The behaviour of the fish and the photosensitivity of the shield on the head appear to indicate that it may be a means of attracting those insects which are usually drawn towards light. It was observed in an aquarium that at night when there is no luminosity the shield is quite dark. It reacts to artificial electric light in the same way as to daylight. This would indicate that during moonlit nights, when myriads of small insects hover over pieces of water for breeding purposes, the silvery head spot is capable of shining and presumably of attracting insects. These facts therefore, appear to support the conjecture that the silvery spot is a specialization which enables the fish to attract the particular kinds of insects required as food. Further investigation is required to confirm this purely tentative theory.

Colouration: When alive the fishes are pretty. Dorsally there is a dark colour tone on a background of buff with a slightly yellowish green tinge. The caudal and anal fins are piped in scarlet. The dorsal fin is yellow and faintly pink at the tips with a basal black dot, and the junction with the body is stippled with silver. The pectoral fins are also yellow and the area behind them is stippled with crimson dots. The body is semi-transparent. The anterior portion of the anal fin is prolonged into two red stained rays. There are 7-8 transverse black bands on the posterior half of the body.

[The mosquito-larvae eating propensities of the genus *Panchax* are well-known, and several workers have already reported the absence of mosquito larvae from pieces of water in which these 'Top-Minnows' live. Mr. Fraser's observations show that *P. lineatus* can live in very foul waters and that it can subsist on aerial respiration alone for considerable periods. Moreover, the tentative hypothesis concerning the function of the silver spot on the head, advanced for the first time, seems to be well worth further investigation. If it proves to be a fact that the silver spot is used for attracting insects, then in *Panchax* we shall not only have an agent for destroying mosquito larvae but also a trap for luring adult mosquitoes that visit suitable pieces of water for breeding purposes. It may be noted that adult mosquitoes have often been found among the stomach contents of *P. panchax* (Hamilton). Reference may also be made to certain fishes, which live in deep seas, and emit light from special organs to attract their prey. It would thus seem that Mr. Fraser's view concerning the utility of the silver spot is not in any way extravagant.

The habits and habitat of *P. panchax,* the well-known *Ti-Choki* fish (the three-eyed fish, in the third eye reference is made to the shining, silvery spot on the head) of Bengal are similar to the Peninsular species—*P. lineatus.* While determining the utility of *P. panchax* in keeping pieces of water free of mosquito larvae, Nair and I kept one valve chamber opposite the Engine Room of the Pulta Pumping Station as a control and introduced no fish in it. In three other chambers specimens of *P. panchax* were introduced early in July. Occasional inspection of the chambers showed that no mosquito larvae were present in the chambers containing the fish, while in the control chamber the water became very foul and in about half a pint of water taken from the surface there were over 200 mosquito larvae on the 7th of August, 1937. Ten specimens of *P. panchax* were introduced in the evening, but two died during the night. More specimens were introduced the following day and by the evening the number of mosquito larvae in the chamber was reduced to 4 or 5 in half a pint of surface water. These observations show that *P. panchax,* like its congener *P. lineatus,* can live in very foul waters and is an effective larvicide.

Two specimens of *P. panchax* were left in a small glass bowl on wet cotton wool and the bowl was covered with a wet piece of cloth at about 8 p.m. At 8 a.m. next morning both the specimens were alive, but one died an hour after, while the second was revived by keeping it in water. This experiment bears out the hardy nature of these fishes, and shows the ease with which it should be possible to transport them over long distances.

In connection with the subject of the larvicidal fishes of India, it seems desirable to refer to an earlier observation made by Mr. Fraser while stationed at Deolali in the Nasik District. He found that a stagnant pool in a disused quarry was kept free of mosquito larvae by a small Carp-Minnow, *Rasbora labiosa* Mukerji, a remarkable fish which has developed a special contrivance, by the hypertrophy of the lower lip, for catching insects by jumping out of the water. The fishes of the genus *Rasbora* are usually regarded of moderate utility in destroying mosquito larvae, but it seems probable that they may prove very useful for local needs in certain areas.—*S. L. Hora.*]

PRINCIPLES OF WILD LIFE CONSERVATION.

By

THEODORE HUBBACK.

(*With* 4 *black and white plates*).

INTRODUCTION.

Are the principles of Wild Life Conservation to continue as elusive conceptions without material form, or are they to become a living presence increasing in virility year by year?

There appears to be a danger that these principles will be sacrificed for private profit. The present tendency to exploit all natural resources regardless of the future will eventually result in the disappearance of many species of the larger fauna unless such tendency is drastically checked.

Until it is recognized that Wild Life is a valuable natural resource and that the benefits derived from an unguarded resource are wasting benefits, waste will continue till the resource has gone and the benefits have vanished.

* * * * *

No natural resource is more sensitive to conservation than wild life, and no natural resource has suffered more from lack of conservation. During the last fifty years species have been exterminated due to this deficiency.

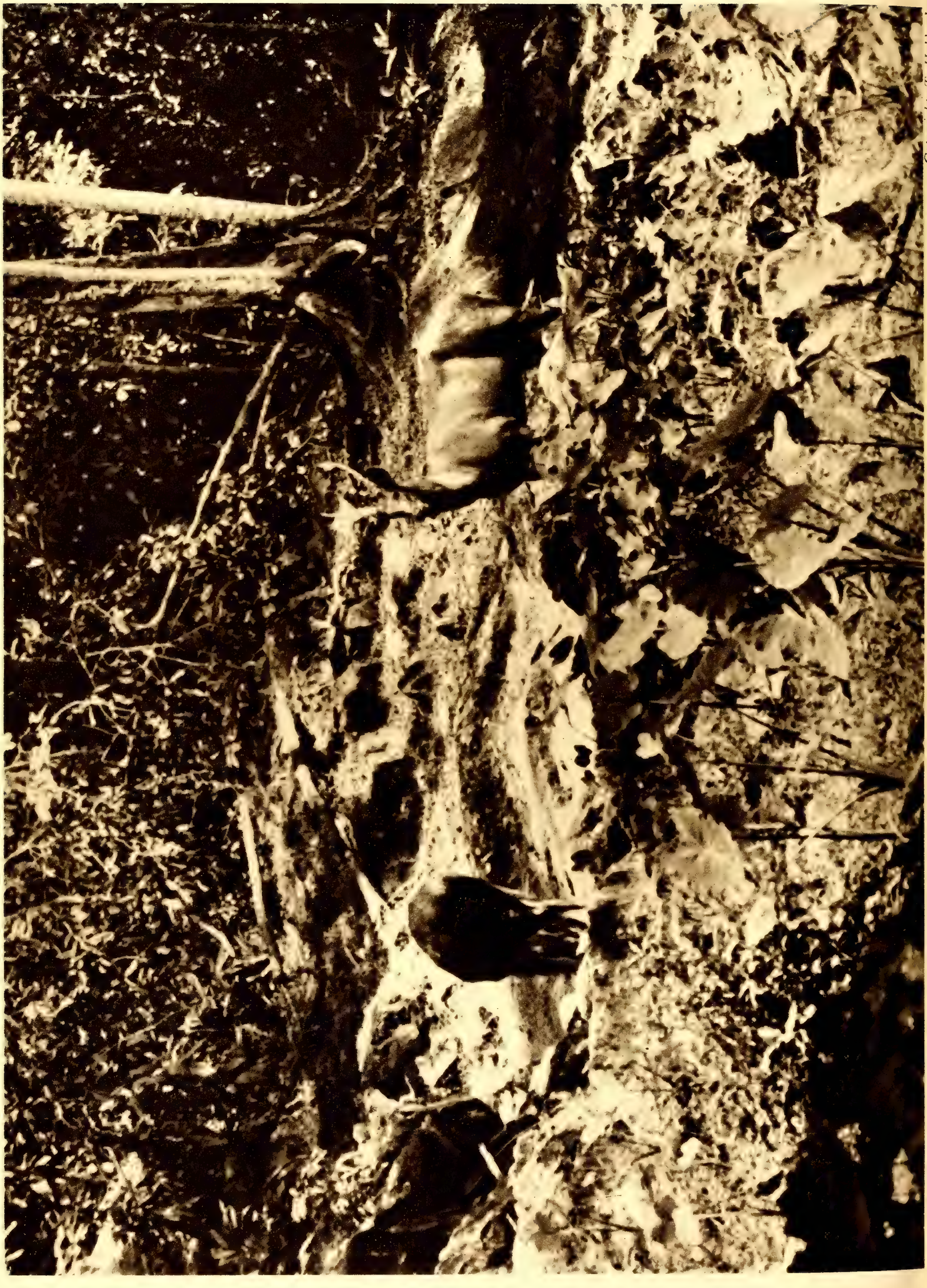
Wild life is only just being recognized as one of our valuable assets, but this recognition is so tardy, especially in some of our Colonies and Dependencies, that there is a very real danger of the recognition coming too late. The days when efficient conservation may be possible are rapidly passing away.

Unfortunately it is a fact that those principles of conservation which it is imperative should be applied to wild life preservation are seldom understood by those who have the power to further or retard the measures desired. The lack of proper financial provision is, I believe, the real reason why in some of our Colonies and parts of India and Burma we are losing our wild life. Those who hold the keys of the money bags never appear to be conservationists!

I shall endeavour to show in this article how senseless it is to expect to save wild life unless the true principles of conservation are recognized and adopted. The 'hit or miss method' of a budget allowance for what is erroneously called 'game protection' will never achieve the saving of our wild life.

To conserve wild life resources you must have a fairly accurate idea of what you have to conserve and what you wish to conserve. In other words, you should know what your stock consists of; you should know where it is to be found; you should have a knowledge of its ecology, numbers and status.

These alone are questions which cannot be answered except after careful research and skilled inquiry.



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OF SAMBHUR IN MALAYA.

Let us take the larger forms of wild life and consider certain species. Wild elephants, for instance, may have, as they have in India and elsewhere, an economic value, apart from the value of their ivory, because they are used for domestic and transport purposes. Therefore, there is probably in such countries a desire to conserve elephants for economic reasons and it is not desired to see the wild stock, the natural resource, exterminated. A wild elephant is certainly out of place in a highly cultivated or industrial area, but not out of place in his jungle habitat, and so long as it is desired to conserve wild elephants for economic reasons, so long should we retain sufficient of their habitat to make that conservation a possibility. But principles of conservation cannot be based solely on such premises. I merely give the above illustration as an instance of one reason for consideration of the problem from an economic outlook.

There is much wild life which we cannot claim as having to our knowledge any direct commercial value to the community, although its æsthetic value may be very great.

One will readily divide the classes of commercially valuable and æsthetically valuable wild-life resources by thinking of fur-bearing wild animals, and the many attractive song-birds which delight our hearts and soothe our nerves. People desire that both classes should be conserved, but for dissimilar reasons. Then again wild life is conserved for recreation all over the world, another reason different from those quoted above.

It is legitimate to presume that there being many reasons for the continuance of wild life in most parts of the world, proper steps for its conservation should be taken, and therefore one would expect to receive the support and approval of the Public for any sound policy of conservation.

It is useless to imagine that you can conserve wild life without spending money on an organization to do so. You get very little in this world for nothing and wild life conservation is no exception to the general rule of having to pay for a good article.

An International Conference for the Protection of the Fauna and Flora of Africa was held in London in November, 1933, and a convention was ultimately signed by the representatives of nine Governments.

Besides the representatives of the Governments immediately concerned the Governments of the United States of America, India and the Netherlands sent observers to the Conference.

This Convention embraced many phases of conservation and should prove of inestimable value to African Fauna and Flora.

Although the recommendations are far-reaching and are vital to a proper system of conservation the question of how the expenditure on such proposals should be met was not referred to in any of the documents published.

Possibly it was not within the province of this Conference to deal with or even refer to the question of financial arrangements: such matters are left to the Governments concerned. Nevertheless the whole constructive policy of conservation may break down, whatever resolutions are passed, unless financial provision is assured for that policy.

It is clear, I think, that as a Nation we are anxious to preserve and keep from extermination the fauna in our charge. To an International Conference for the Protection of Nature held in Paris in July, 1931, the Prime Minister, Mr. Ramsay MacDonald, sent a message of which the following is an extract:

> 'In the Territories for which they are responsible His Majesty's Government in the United Kingdom regard themselves as trustees for the Protection of Nature not only in the interests of their present inhabitants, but in those of the world at large and of future generations.
>
> 'The wonderful fauna and flora with which Nature has endowed the world have already suffered grave losses. Animals and plants of great scientific interest and often of great beauty have been exterminated, objects of great geological interest have been destroyed and the beauties of Nature defaced. Lovers of Nature may do much to stem this process, but if their object is to be secured the active co-operation of Government is essential.'

The obligation of a Nation towards the wild life in its territories is well stated in a speech made by the present King of Belgium, when he was still Prince Leopold, at a dinner of the African Society held in London on November 18, 1933. He said:

> 'The protection of nature raises problems of universal importance, the evolution of which cannot be left to the initiative of isolated groups, whose action is necessarily limited, and who are unable to enforce in their entirety the effective measures of preservation which are necessary.
>
> 'The State alone can and must take the responsibility for a protective organization which will command the interest of all mankind in its moral, social, economical, and cultural development; and thus the political aspect of the question becomes apparent.'

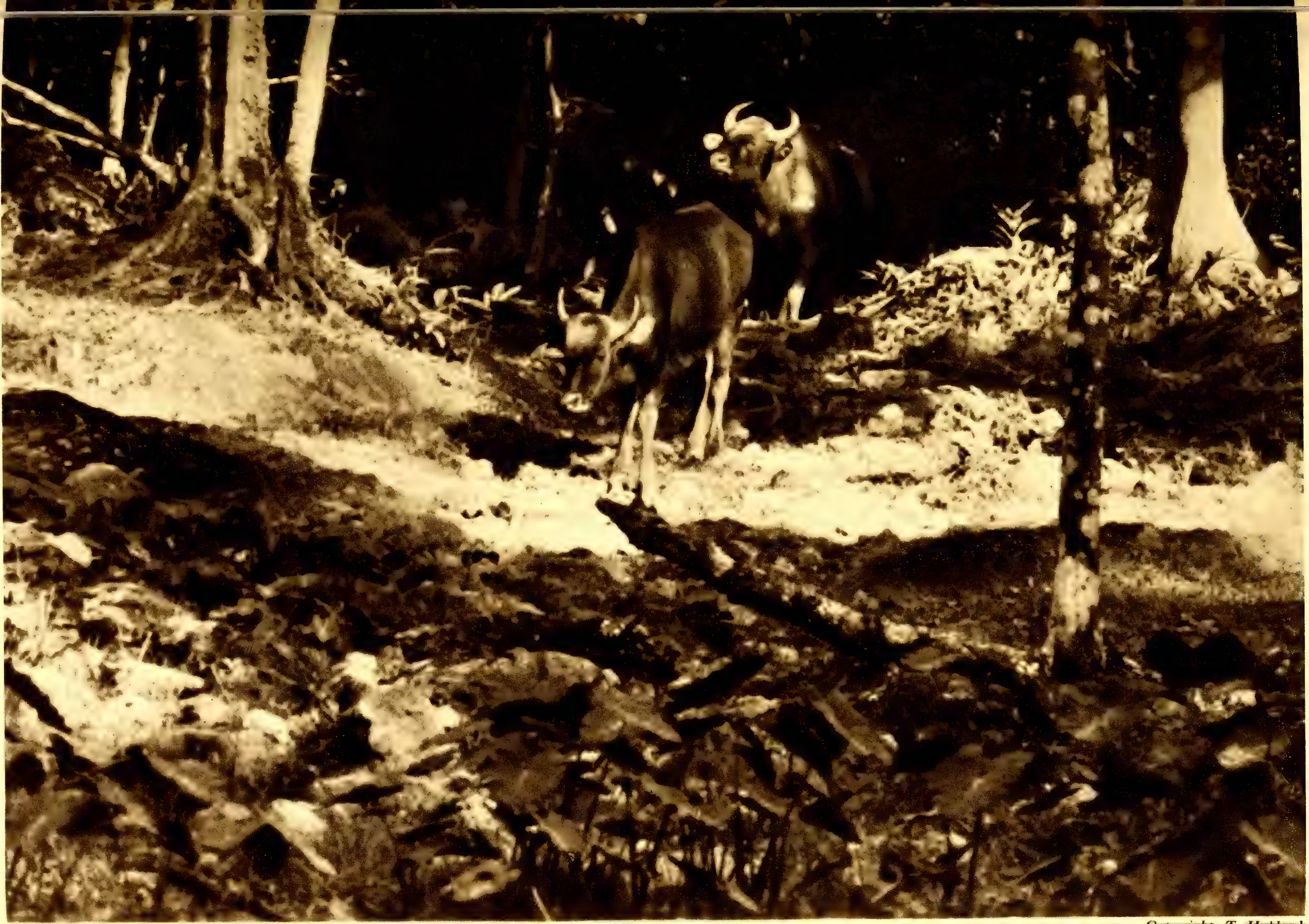
Are we, as a Nation, to allow the conservation of wild life to be undertaken by local Governments as a purely domestic policy? The pronouncement of the Prime Minister is against this.

Yet during the last few years, serious steps have been taken by local Governments to prejudice considerably the work of conservation by withholding funds and reducing personnel, making constructive methods impossible. Financial stringency has been the excuse.

In my opinion these unfortunate *contretemps*, which most seriously affect the status of the fauna, can be and should be avoided by a recognition of the fact that there is an intimate connection between the revenue derived from Wild Life Resources and the amount of money that can be spent on its conservation.

This is the base on which a sound financial policy for efficient conservation can be built.

Whatever laws are passed, without adequate means to enforce them, the work of conservation must fail; and to inaugurate successfully a real service for the conservation of wild life there must be



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A COW SELADANG AND HER CALF ENTERING A SALT LICK. OBSERVE HOW THE COW IS TESTING THE WIND.

a definite financial policy to deal with it. So long as funds can be cut off, which reduce, or even abrogate, the service for conservation, while the methods of destruction are left unchecked by any practical application of the law, so long will our work fail. We must appreciate the fact that failure means the ultimate disappearance of the wild fauna.

We are not concerned at the moment with the laws: their general principles are, broadly speaking, agreed to, and although not consistent throughout our Territories and Colonies could easily be brought more or less into a condition of co-ordination. The great importance of inviolate reserves is now widely recognized, but steps to implement the laws for such sanctuaries are awaited.

What we are concerned with are ways and means to enable the laws we have to be properly enforced.

A method has been adopted in many parts of the United States whereby a 'Game Fund' is established by law—embodied in fact in the Game and Fish laws—by which all revenue, direct and indirect, derived from Wild Life Resources is credited to the Fund. That money is kept apart from the general revenue and earmarked for the conservation of wild life. The most striking example of the success of this method can be seen in the results obtained in Pennsylvania, U.S.A. This State was 'shot out' in 1890, but in that year a few of the people realized that drastic steps would have to be taken if their wild life was to be saved. Finally a Board of Game Commissioners was appointed, and when the Board began its work in 1896 its funds consisted of the sum of G. $800 only. In 1913 a sum of G. $97,000 was available; in 1930, G. $1,413,251 was the amount budgeted for the fiscal year, June 1, 1929, to May 31, 1930.

Not only was a large revenue obtained, but a 'shot out' State was turned into one of the best sporting States on the eastern side of North America.

Can we afford to ignore such methods which have proved so strikingly successful? I think not.

Another method is by the 'yard-stick,' whereby the amount to be spent on conservation of wild life is budgeted according to the estimated revenue for the year from Wild Life Resources.

But whichever system is used it must be laid down by law that in the case of a fund—call it 'Wild Life Fund' if you like—that fund cannot be raided or interfered with by the Legislature. The Budget Commissioner, or whoever is the officer handling finance, cannot be allowed to interfere with the proposed expenditure provided it is within the estimated revenue of the fund, or the limits of the measurement by 'yard-stick.'

Whichever system is adopted it must be recognized that the service for the protection of wild life will be expected to protect certain types and forms of the fauna which do not produce any direct or indirect revenue, but still require expenditure on their preservation for other reasons.

It may therefore be necessary before a substantial fund has been built up, to obtain from the general revenue funds for the conservation of insectivorous birds, and other forms of wild life which are of utilitarian value. Later on, as in Pennsylvania, when a solid revenue is assured, such requests will be unnecessary.

The direct and indirect revenue which should be credited to the department for the conservation of wild life should consist of:

Game Licences.
Licences and Permits for Sporting Arms.
Import and Export Licences for Sporting Arms.
Duties on Sporting Arms.
Duties on Sporting Cartridges.
Licences for Purchase of Sporting Arms and Sporting Cartridges.
Licences to Sell or Store Sporting Arms and Sporting Cartridges.
Fishing Licences.
Fines and Costs.
Sales of Confiscated Articles and Picked-up Trophies.

The expenditure should include:

Salaries, Allowances and Transport of Officials.
Construction work on and maintenance of National Parks, Sanctuaries and Reserves.
Building and Maintenance of Offices.
Predatory Animal Control.
Fencing.
Rewards.
Court Expenses.
Sinking Fund for Leave, Gratuities and Pensions.

The officer in charge of the conservation department, with the opportunities that a stable financial policy would give him, could surely organize a service which would not only benefit the wild life of his country but would be of inestimable value to the country itself.

What we are now doing for conservation of wild life in many places is just so much waste of time, because we have never got past the stage of treating the work as a casual matter which can be undertaken by anyone.

It is useless trying to build up a staff knowing that just as the work of conservation is beginning to make its mark it is liable to be dispensed with at the behest of some ephemeral office holder.

The whole matter turns on proper measures being taken to finance the work required. If the system of the 'Wild Life Fund' is adopted, and the organization necessary and possible with the funds obtainable placed in the hands of experienced conservationists, success is assured.

Adequate funds at the disposal of an efficient organization—you cannot have such an organization without adequate funds—would enable the proper guarding of wild life resources, the proper policing of sanctuaries and reserves, the building up of a loyal service for these objects, all of which are quite impossible so long as the position of the staff and the execution of the work has no foundation for lack of a financial policy.

In actual practice the work of successfully conserving wild life

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is one of considerable difficulty and is highly specialized work. Few have the aptitude to become practical conservationists, and still fewer have the knowledge or experience to enable them to exercise that aptitude if they possess it.

But the real menace to any sound policy of wild life conservation lies in that ugly word 'indifference.' This is generally synonymous with 'ignorance'. The latter is easier to overcome. There is often a feeling, in a new country especially, that exploitation can be better carried on by not paying too much notice to the claims and rights of the indigenous fauna. In the United States of America there has frequently been an outcry against the creation or extension of a National Park by certain of the get-rich-quick fraternity. These people are sometimes described by the elusive expression 'vested interests.' This class of opposition to the conservation of natural resources will be found in many places, generally coming from local inhabitants who are looking for immediate profit and immediate 'development.' Sometimes this indifference to conservation is shown by Governments—no doubt for the same reason.

The opposition to a National Park project may come from the fact that the conservation would then be real and effective. That, I think, is the truth.

By leaving the financial arrangements for the service of conservation to local Legislatures we are taking a great risk of losing our fauna altogether. Some Legislatures might not object to a *dénouement* !

India, Burma and Malaya have adopted a policy by which many firearms are now in the possession of those whose observance of the laws for the preservation of wild life is only governed by the chances of detection if such laws are disregarded; and although during the last few years the issue of weapons for the destruction of wild life has been great, funds or personnel to ensure the observance of the laws for preservation have not been increased, in some cases they have even been curtailed.

Usually the argument used to justify the supply of arms to the ryot is to enable him to defend his crops; in most cases his crops can be much more efficiently protected by a stout stake and rail fence. In the case of large wild animals, such as elephant, the frequent wounding by firing at them with any sort of missile, even bird shot, merely aggravates the trouble. Guns issued for crop protection are used for poaching, and such poaching can only be kept in check by the enforcement of an energetic policy through an adequate organization.

In the Dominions, especially Canada, the value of the conservation of wild life is well recognized and the work well organized. It is in countries such as India, Burma, Ceylon, Malaya, British Borneo and parts of Africa that so much yet requires to be done.

The principles of conservation have not been fully and generally applied in these countries.

In India there are no appointments of Game Wardens as such, conservation work being entrusted, as a side-show, to the Forest Department. Burma had a Forest Officer appointed as a whole-time Game Warden, but directly there was financial stringency, the billet was discontinued, and is still discontinued. A Forest Officer with a full-time job was appointed as an Honorary Game Warden; he subsequently resigned. Another Forest Officer has now been appointed Game Warden.

At the recent Conference on Indian Fauna it was resolved that the Provincial Governments should be asked to appoint Game Wardens. Also that licence fees, etc., accruing from wild life resources should be spent on conservation.

Even these principles had not been recognized, or at least not publicly advocated, in India as vital to the conservation of wild life.

Dr. R. L. Spittel, President of the Ceylon Game and Fauna Protection Society, speaking in London at a meeting of the Society for the Preservation of the Fauna of the Empire on October 8, 1934, did not hesitate to emphasize the parlous condition of the wild life in that Island. Here are some extracts from his address:

'Those who know our jungles have long realized that unless protective measures are instituted, the wild life of so small an island as ours would soon be doomed.

The story of the Ceylon Game Protection Society, since its birth some thirty-eight years ago, is that of a long-sustained struggle to interest Government in the protection of the larger fauna, which, but for its efforts, would hardly be worth speaking of, to-day.

Owing to the interest taken by Sir Henry McCallum, the then Governor, the Dried Meat Ordinance was passed in 1908 and the Game Protection Ordinance in 1909, when the Yala and Wilpattu Sanctuaries were established; the first real step in protection was then taken.

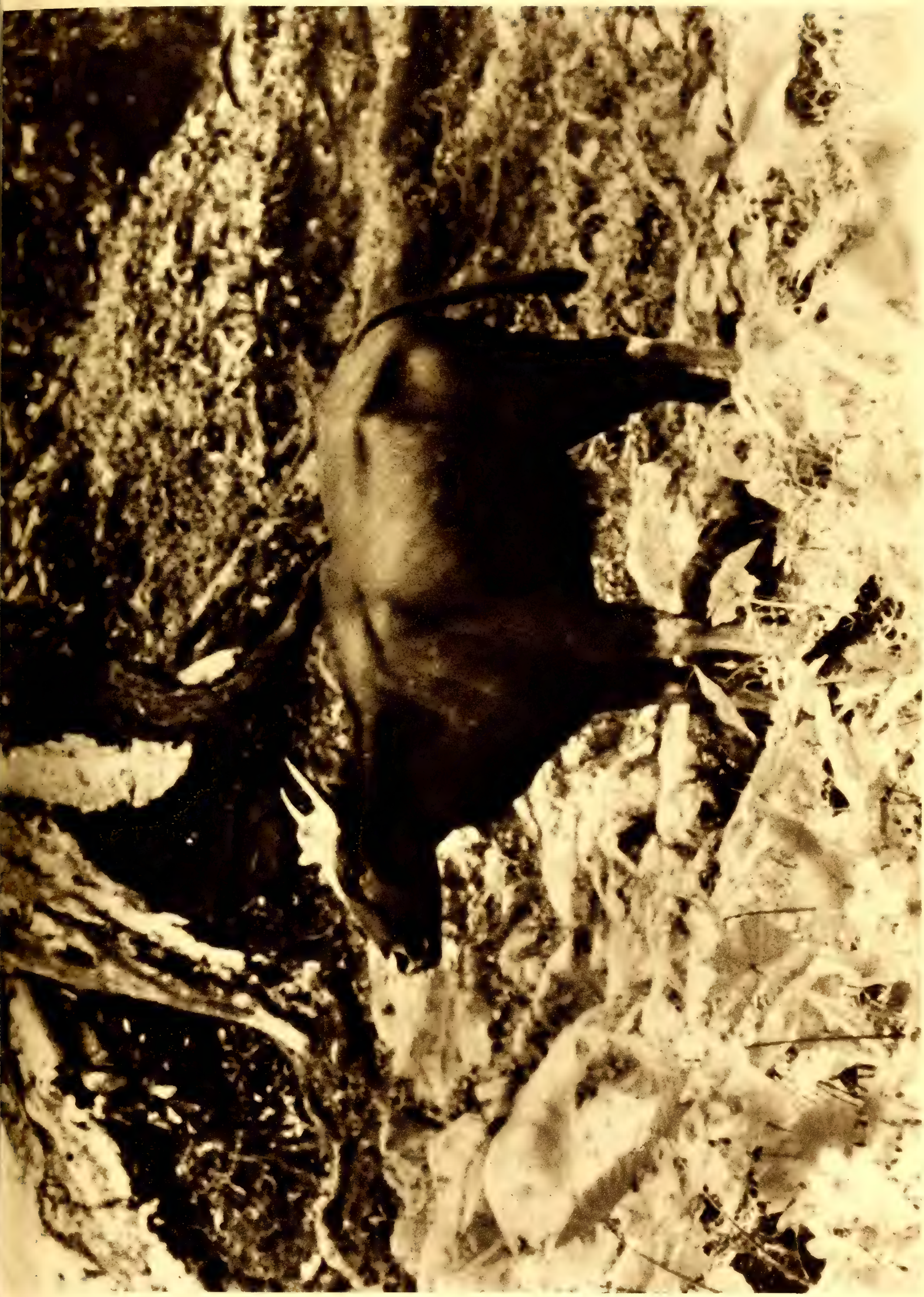
But since that time things were allowed to drift, and the situation was becoming very alarming.

Game is now scarce even in our remotest jungles, largely because thirsty animals are killed in months of drought (June-August) at water-holes, and their dried flesh bartered. Up to some years ago shooting had to be done by moonlight. The slaughter then was not anything like as terrible as it became with the introduction of the electric torch, by the aid of which animals could be killed nightly throughout the year.

But worse than that, parties began to ply the jungle roads at night in cars equipped with powerful spot-lights, carrying a battery of guns and hand-torches. They blazed away at the gleaming eyes of "timid hunted hares", deer, leopard, or anything they met. One such car to my knowledge was responsible for six deer and a dozen hare in a single night and another for twenty-eight hare in a few hours. One man, accustomed to driving out occasionally for an hour or two at night, accounted in about six years for no less than thirty-five leopards.

When animals thus worried became shy of the roads, the "spot-light sportsman" carried his torch along jungle paths, giving the creatures no quarter in their seclusion.

Then breech-loaders became cheap and began to replace the muzzle-loaders of villagers, who also acquired torches, and the



YOUNG BULL SELADANG OF ABOUT TWELVE MONTHS OLD TAKEN IN A SALT LICK.

Copyright, T. Hubback

> animals were harassed out of existence. Their carcasses always commanded a ready sale to passing buses.
>
> You will inquire, "Were there no games laws to put a stop to this?" There were, but they were not enforced. A policy of *laissez-faire* made even people who should have known better forget the existence of these laws. There was no prohibition against the shooting of any but game animals by night, even with spot-lights from cars. And men going out on the pretence of shooting leopard and pig did not scruple to kill any sambhur and deer they met. Sport had degenerated into night-shooting with lights or driving jungles with gangs, legitimate stalking being practised by few.
>
> We, like other countries, realize to the full that this is the age of the destruction of the world fauna, and that many species will be exterminated unless provision is made for their protection.
>
> The spectacle of wild animals in their natural surroundings is one of the greatest joys of man. The true sportsman gradually becomes the champion of wild creatures, and it is chiefly owing to his initiative and understanding that sanctuaries have been established. Nowhere, perhaps, has this been better exemplified than in Ceylon. The religion of the land is mainly Buddhism—perhaps the only religion in the world that extends its benevolence to animals—yet the outcry for protection has come not from the Buddhist, but from the men who shoot.'

A sorry picture of the failure of a Colonial administration to enforce its own laws.

Malaya has been, due to unstable and vacillating administrative methods, in a state of disturbance and uncertainty regarding what should be done for wild life, and is still in that state, despite the fact that a full constructive programme in the Report of a Commission appointed to inquire into the whole matter was submitted to the Malayan Governments so long ago as 1932.

In Africa recent reports made at the instance of the Fauna Society showed that in West Africa at least no satisfactory methods of wild life conservation exist.

The destruction of elephants in Uganda goes along merrily, and the following figures taken from the Game Warden's Reports are instructive:

1930 . . .	892	These elephants were officially destroyed.
1931 . . .	1,211	
1932 . . .	1,210	
1933 . . .	1,380	
1934 . . .	1,603	

In the Annual Report of the Uganda Game Department for 1934, the following words appear (para. 34):

> 'This gives an aggregate wastage of 13,096 elephants, which is the minimum for the period (ten years), and with the addition of tuskless juveniles which are not shown on the returns, and a percentage of elephants which perish in swamps and are never

found, the grand total can be taken to be approximately 14,000, truly a stupendous figure.'

Stupendous indeed !

The stock of elephants must be enormous to stand this destruction, because in addition to the above figures, many hundreds of elephants must have been killed or died in other ways. But perhaps this is merely the backdoor to 'birth control', because such disturbance as must result from the harassing, inseparable from so much killing, must react to hinder normal breeding. There is some fatal period reached in the life-history of wild animals when the continuing abnormality of a disturbed existence appears to break their spirit and they are then liable to cease to produce their species. This psychological phenomenon is not properly understood, but is recognized as existing by persons who have studied wild life at close quarters.

These are only meagre outlines, space forbids an extensive review, but they indicate that we have a long way to go before the principles of conservation are applied as they should be applied in some of our Possessions.

In America it is now fully recognized that organizations for wild life conservation are necessary and that proper financial support should be forthcoming based on the revenue which accrues from wild life resources.

Wide latitude in dealing with the funds at their disposal is given to the officers who carry out the conservation programme.

To illustrate this policy I wish to quote from a statement made by Mr. Slautterback, the Executive Secretary of the Pennsylvania Game Commission, at the annual meeting of the American Game Association, held in New York, in December, 1929. Mr. Slautterback having addressed the meeting on the subject 'Budgeting Game Funds,' was asked certain questions and gave certain answers. Here they are :

MR. ADAMS : As I understand it, you have a separate game fund in Pennsylvania to which all the revenues from licences go automatically, but in making any expenditure against that fund must you receive legislative sanction?

MR. SLAUTTERBACK : No.

MR. ADAMS : Must you get sanction from any budget commission or any one outside of the game department?

MR. SLAUTTERBACK : We prepare our budget, holding it within our expected revenue. This is presented to the officer and he naturally approves the budget if our several items are within the estimated revenue. I am referring to the state budget officer.

MR. ADAMS : In the last analysis have they the authority if they wish to use it of making any changes in your set-up, or simply inspect it to be sure that it stays inside of your anticipated revenue?

MR. SLAUTTERBACK : Your explanation is correct—to inspect it to see that it remains within our revenue but to be used for no other purpose except for game protection and propagation purposes, Chairman Quinn: Your budget commissioner has no authority to disapprove the budget if it is within your income?

Mr. Slautterback: He has not.

Judge Miles: I would like to ask if it is necessary that the funds accumulated to this department have to be appropriated by the Legislature before it is available?

Mr. Slautterback: They are not appropriated by the Legislature.

The Game Commissioner is made responsible and is held responsible for the work and is given the power and means with which to do it.

As the exact opposite of this, I should like to mention a case in Malaya where a Game Warden's monthly bills were held up and sent back to him, although they were certified by the guarantee of the Game Warden's signature, because one bill, a recovery for a small petty-cash payment to an illiterate native, was witnessed by one person only and not by two as required by a general order!

Such red-tape entanglements can scarcely come within the category of the 'principles of conservation.'

After all, what are the principles of conservation which we can apply to wild life?

I think we may claim that the chief object of conservation of wild life must be to prevent the disappearance of species. We cannot say we don't want such-and-such a species because it eats our fowls or disturbs our garden; its benefits to the universe in other ways may be more important than our pet fowls or our local garden.

We can say we don't want such species in our backyard and we can take steps to protect our property, but we are wrong if we say such-and-such species should be exterminated. Our knowledge is much too incomplete to allow us to say anything of the sort.

Most people would have answered in the affirmative a question regarding the desirability of the extermination of the shark, and yet the first discovery of insulin, a drug which has brought relief to thousands of diabetics, was made in the liver (pancreas ?) of a shark (see *Journal of Mammalogy*, No. 2, vol. 6, p. 87, 1925).

Therefore, I think the practical application of steps to prevent extermination of species must be the foundation on which to build our framework of conservation.

This can be done in many ways, but the most certain, most equitable and most spectacular method of achieving this is by setting aside certain areas of suitable land as permanent sanctuaries for the fauna.

Conservation must be recognized as a specialized subject and the execution of the duties necessary to conserve any natural resource should be entrusted to, and undertaken by, persons whose training and practical experience enable them to know what is required to make such conservation a success. This sounds like a platitudinous argument which is redundant in its obviousness; and so it is, but unfortunately the intelligent minds in this world are in the minority, and it often happens that conservation work is looked upon by the unenlightened mind belonging to someone who is in a position to place conservation on a low plane of activity, as work which can be looked after by anyone as a spare-time job. No greater mistake could be made. Until it is recognized as essential to make full-time appointments for those in charge of the work of preservation and protection, so long will the work fail; as it has failed everywhere in countries where preservation of the fauna is professed but the application of the principles of conservation refused. Certainly we must recognize as one of the practical applications the entrusting of the work to persons with full responsibility to carry out the duties necessary.

We must guard against a present tendency to treat a Game Warden as a conservationist only as a last resort. He may be expected to devote too much of his time looking after the interests of agriculturists leaving him insufficient time to attend to matters relating to conservation. Funds may be voted for control schemes, which generally mean destruction of some sort or other, rather than for guarding sanctuaries or for enforcing the game laws. A Game Warden is expected to take action to relieve cultivators when they allege damage to crops by wild life, irrespective of the condition of the cultivation; the indolence or industry of the cultivator; the feasibility of prevention of damage by fencing or other non-lethal methods. Advice which does not include the killing of something is unwelcomed, sometimes because a killing means a feast, and sometimes to satisfy a desire for revenge. Revenge on a wild animal! What a high ideal for a human being.

But, if a Game Warden is to achieve the objects of conservation he must only take extreme measures when really necessary. It is unfortunately the truth that much unnecessary killing, wounding and suffering is inflicted under the guise of crop protection. Have a proper financial policy with a Wild Life Fund; allow the Game Warden full powers to spend it; then these matters would be dealt with by those who would know what to do and relief could be, and no doubt would be, given to cultivators by fencing and other methods. The dangerous policy of 'control' if not properly controlled is a real menace to the future of many species.

An important principle of conservation is the utilization of natural resources for the benefit of mankind. We cannot improve on Theodore Roosevelt's definition of conservation as 'preservation through wise use.' Only such use may be made of wild life species which we desire to conserve as will ensure that the stock is not dangerously depleted.

A wise policy of wild life conservation will provide for:

(1) Adequate laws for protection.

(2) Adequate areas as permanent sanctuaries or refuges for species in their known habitat.

(3) Adequate organizations to enforce the former and administer the latter.

If these three principles are insisted on, then we may have some hope for the future of the fauna of our Empire, but unless steps are taken, and taken soon, to recognize the critical state of the wild life in many of our Colonies and Dependencies, and to check the present rate of destruction, the future can be contemplated only with apprehension. To those who know how inefficient and inadequate in many places our methods of wild life conservation are, the wild life in such places appears doomed to extinction.

You can replace trees; you can sustain domestic animals by private breeding; but wild life must have an environment of its own in which to thrive and increase in a natural and normal fashion.

The price to pay for the neglect of the observation of conservation principles as applied to wild life is a terrible one—no less than the disappearance for ever of species after species.

'Qui nunc it per iter tenebricosum illuc unde negant redire quemquam.'

MISCELLANEOUS NOTES.

I.—WILD BEASTS—REAL AND APOCRYPHAL.

The description of the skin of a Blue bear (*Ursus arctos pruinosus*) from Eastern Tibet, by Captain R. K. M. Battye and Mr. S. H. Prater in Volume xxxviii, No. 3, page 610 of the *Journal* is of special interest, not only as relating to an animal first described by Edward Blyth in 1853, but in view of recent correspondence in *The Times* regarding footprints of so-called 'Mountain Men', seen by Mr. Ronald Kaulback at an elevation of 16,000 feet in the Tibetan interior during a journey in December 1935. Mr. Kaulback could not identify the footprints as those of any particular animal, but he wrote that they were 'very extraordinary tracks. There were five sets of them leading down the side of the valley through the snow, at an almost impossible angle, and on to the comparatively level floor. Unfortunately there had been a very slight fall of snow, and the tracks were not completely clear, but they looked exactly as though they had been made by bare-footed men. There are no bears in that part of the country'. He thought they 'might have been the pug-marks of snow-leopards going slowly with the hind-paws overlapping the fore, but had never heard of these animals travelling in a party'. There is, however, no reason why snow-leopards, like other felines, should not so travel; tigresses have been known with four well-grown cubs; a pack of six panthers were seen walking across a jungle glade in Berar, just like a pack of hounds; and lions are frequently observed in large parties. Four or five bears may be met with together.

Two of Mr. Kaulback's coolies favoured the snow-leopard theory, while two said the footprints were those of 'Mountain Men', a wild race which they all agreed lived in the snow, described as being 'like men, white-skinned, naked, with long hair on the head, shoulders, and arms'. That is what a bear may look like. Its tracks, at least of the hind-feet, are just like those of a bare-footed man; the bear, like the man, has long hair that may fall over the head at times, when, for instance, it descends a mountain side 'at an almost impossible angle', as a sportsman who shoots at a bear above him will find; an isabelline bear may be as white as a polar bear; in India *bhalu* or *reench,* the bear, with his skin stripped off, is very like a grotesquely-shaped human being; he is known as *adamzad,* 'man-kind', and the Hill-man, when in the depth of the forest, always refers to him as *Rishi,* that is 'Master', says Mr. F. W. Woods. One of my beaters in Berar had a strong growth of black hair on his shoulders and back; the other men nicknamed him 'bhalu'.

Certainly indications point to the tracks being those of bears, notwithstanding Mr. Kaulback says there are none in the district, where, however, he spent only five months. Even if they are not always found in that part of the country, these and other animals often travel and stray far from their usual haunts. The habitat of the Blue Bear, described by Captain Battye as being 'in the bare mountains where there is no jungle and where there is snow lying for seven months in the year', corresponds with the description of this Tibetan region. There is no reason to look for marvels and suggest that the tracks 'may have been made by some unknown relative of the Giant Panda or Snow Bear', as does one correspondent writing from what *The Times* terms 'the British Museum (Natural History) stable', adding that 'dramatists have so often used unknown relatives to explain away improbable occurrences that there seems no reason to make apocryphal additions to the Panda's family circle in order to evade the issue'. Moreover, if improbable unknown Pandas, (the Panda feeds only on bamboo shoots), may exist in that region where there are no bamboos, why not far more probable bears? It may also be remarked that Pandas are bears to natives but not to science, while *Ursus isabellinus* has priority of claim to the name of 'Snow Bear'.

From the same source as the apocryphal Panda comes the suggestion that the tracks might be those of langur monkeys. This was ruled out by Mr. Kaulback, for the footmarks were found 3,000 feet above the tree-line, while the creatures that made the tracks had both come down and returned to a considerably higher point on the mountain. The only interest of this suggestion is that a similar one was made regarding the *Mamh* or black bear in Baluchistan, which excited considerable controversy in India some sixty years ago, 'some writers maintaining that it was a mythological animal, and others that it was a monkey' (see Valentine Ball's *Jungle Life in India*, 1880, page 447). Bears had hitherto been unknown in Baluchistan, when the production of a skin led Blanford to suppose that the animal was a new species which he called *Ursus gedrosianus*. It was afterwards identified as the Himalayan Black Bear, *Ursus tibetanus* or *torquatus*. The earlier specific name of that animal is itself of interest, for the species is unknown in Tibet. Lydekker, however, refers (*Game Animals of India*, p. 388) to a local race of Malayan Bear, *Ursus malayanus*, occurring in Eastern Tibet.

As for mythical monsters, conjured up not only into the native imagination, it is surely time to put them in their proper place in the realms of mythology, whether they be Mountain Men in the Himalayas, Mahoni in Alaska, or Grey Seals in Scottish lochs, transformed by local imagination into 'monsters of the prime'. Meanwhile reports of new species or varieties of fauna must be received with caution; even black tigers have proved to be leopards; obliterative colouration has strange effects, and a leopard in shadow may look like a lion in the way!

BAFFORD GRANGE, R. G. BURTON.
CHARLOTN KINGS,
GLOUCESTERSHIRE.
October 4, 1937.

[The discovery of mysterious footprints in the snows of the higher Himalayas have drawn various conjectures as to the identity of the owners. Most appealing to the popular imagination is the theory that the footprints were made by a mysterious race of 'Mountain Men' to whom local legend ascribes the name 'Abominable Snowmen'; the term 'abominable', it has been explained by a correspondent in the *London Times*, is used by the Himalayan folk, not in disparagement, but in the fear and reverence due to that which is 'awful'. The belief in the existence of a race of demigods or their reincarnations has its origin in Hindu Mythology. Hindu Epic Literature abounds in stories of warriors and sages who, relinquishing the world and its vanities, retired into the Himalayan fastnesses, where by fasting and meditation, they overcame the forces of Evil and acquired such spiritual power as made Gods and Men tremble. Stripping the meat of fiction from the dry bones of fact, the most likely conclusion that we can arrive at is that the footprints were those of bears. The species concerned being either the Kashmir Brown Bear (*Ursus arctos isabellinus*), which ranges from Thian Shan to the Western Himalayas or the Tibetan Blue Bear (*Ursus arctos pruinosus*), which ranges from Western China into Tibet. These bears keep to the higher elevations in summer living chiefly on the grass slopes above the tree line close to the snow and the human-like impress of their broad feet in the snow, with some imagination, might be taken for the tracks of the so-called Abominable Snowmen—EDS.]

II.—MEASUREMENTS OF TIGER.

With reference to Mr. Marshall's note on measurements of tiger in the Naga Hills, Assam, I give below measurements of a few tigers shot in the North Coimbatore jungles. One of these, a male, (length : 9 ft.) weighed 366 lbs.

I also give measurements of panthers shot in the same area including, some weights, and also the weights of four bisons shot.

Tiger		*Panther*		*Bison*
Male	: 8′8″	Male	: 7′	Bull : weight 1530 lbs.—height 6′—spread : 37″ .
Female	: 8′6″			
Female	: 7′	Do.	: 7′	Bull : weight 1900 lbs.—height 6¼′—spread : 34″.
Male	: 9′10″	Do.	: 7′2″	
Female	: 8′7″			Bull : weight 1720 lbs.—spread : 33½″ (7½″ × 21″) very old bull.
Do.	: 7′5″	Do.	: 7′	
Do.	: 7′10″	Do.	: 7′½″	Bull : weight 1700 lbs.—spread : 36″.
Male	: 8′	Do.	: 7′6″	
Do.[1]	: 6′6″			
Do.	: 6′6″	Do.	: 6′9″	
Do.	: 9′2″	Do.	: 6′9″	
Do.	: 9′			
Do.	: 8′6″	Do.	: 6′9″	
Do.	: 8′6″	Female	: 6′6″	

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[1] Tailless Tiger.

Tiger		*Panther*		*Bison*
Female	: 8′2″	Male	: 8′2″	(shot and measured by Capt. J. Todhunter, R. A.).
Male	: 9′3″			
Do.	: 9′5″	Female	: 6′	
Do.	: 9′	Male	: 6′10″	
Female	: 8′10″	Do.	: 7′4″	
Do.	: 8′2″	Do.	: 6′11″	
		Do.	: 7′3″	Weight 131 lbs.
		Do.	: 6′8″	,, 91 lbs.
		Do.	: 7′2½″	,, 132 lbs.
		Do.	: 7′3″	,, 143 lbs.
		Do.	: 7′4″	,, 131 lbs.
		Do.	: 6′6½″	,, 145 lbs. (abnormally short tail).
		Do.	: 6′10″	,, 132 lbs.
		Do.	: 7′	,, 125 lbs.
		Female	: 5′9½″	,, 60¾ lbs.

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O.,
SOUTH INDIA.

R. C. MORRIS.

III.—CURIOUS BEHAVIOUR OF WILD DOGS AND A PANTHER AT A KILL.

I am writing you a curious incident which I have personally come across while bringing to book a 'notorious cattle lifting panther'. The panther measured 7 ft. 5 in. round the curves. It was a very cunning beast and it was causing a lot of damage to the calves. It was decided to tie a kill on a raised platform about 5 feet high and then to shoot the panther with a spot light. A kill was duly reported and as a major portion of the kill was already devoured, it was thought best to remove the old kill and tie up a fresh goat. I sat up and about 7 p.m. it was seen that two jungle dogs came near the raised platform where the kill was tied up. Shortly afterwards the panther also came, and sat at some distance from the tied-up goat. It did not at all mind the presence of the two wild dogs. The panther was killed with a neck shot while sitting, and the dogs were moving about when the shot was fired only at a distance of 20 yards from the panther. This is rather a curious incident and I thought it better to put this in writing as it may be interesting to the readers of your *Journal.* Could any reader kindly throw more light on the subject?

RAMANUJ SAREN SINGH DEO, C.B.E.,
Maharaja of Surguja.

RAGHUNATH PALACE,
AMBIKAPUR (SURGUJA),
EASTERN STATES AGENCY.
November 13, 1937.

IV.—UNUSUAL MAULING BY A LEOPARD.

During May last year a party of Survey labourers were working on the re-survey and clearing of the old 'cut' boundary of the Yala Wild Life Sanctuary, which soon will be Ceylon's Strict Natural Reserve.

The place where the sad accident happened is very thick forest with hardly any small glades.

K. Charlie, the deceased, was in charge of a party of five Survey labourers.

Having returned at noon for their meals, the party left their camp again at 1 p.m., each man taking a katty, but no other tools or arms.

K. Charlie went a little ahead of the men (it must be noted that this was just after 1 p.m.), to try and locate an old picket and a blazed tree marking the old and overgrown boundary.

Suddenly the men heard him screaming, and suspecting he had been attacked by some wild animals, they ran after him, shouting to scare away any animals, and found Charlie some 12 chains further on bleeding profusively from severe injuries all over his body, and crying out that a leopard had suddenly pounced on him and wounded him. They tried to take the wretched man to the nearest hospital, at Tissamaharama, some 20 miles away, but he died *en route* and was given a last resting place near the scene of his labour in a wild and inhospitable part of the country where he lost his life when serving his Department.

According to the enquiry the deceased had stated that the leopard had suddenly charged him, this at about mid-day, a most unusual time for a leopard to feed at a kill. It was stated that there was a carcass, but it is not stated where that carcass actually was when the animal so suddenly mauled the labourer.

Perhaps the man disturbed the animal in its sleep near its kill, and in surprise and anger and by way of self-defence it at once went for and attacked the intruder.

Nevertheless the sad accident is so unusual that I think it is worth recording.

The hearsay report that 'leopards sometimes attack pilgrims to Kataragama,' (some twenty or twenty-five miles away,) and 'there is every possibility of animals which have tasted human flesh roaming about in the neighbourhood' seems to me most unlikely. It is also very unlikely that the man disturbed the leopard actually while it was feeding on the kill at that hour of the afternoon. It seems hardly possible to me that the man could have made his way through that very thick undergrowth so quietly that the leopard would not have heard his approach.

The sad accident happened at a spot on the old boundary, miles from anywhere, and where no one had been for very many years until this Survey party arrived to re-survey the boundary. If the leopard was not wounded, the case is a very unusual one for Ceylon.

The true facts of course can never be known, but in many years out here I have never yet heard of a leopard, which had not been fired at, suddenly attacking a man in Ceylon, except for the well-known man-eater of Punanai, one of the rarest cases of man-eaters ever recorded for Ceylon.

Not very far from there, walking quietly along a narrow game track and unarmed, a leopard, a very fine male, suddenly slipped out of the jungle some ten yards from where I stood, a magnificent sight, I actually saw him 'grin' and with one bound he had disappeared.

A. C. TUTEIN-NOLTHENIUS,
F.Z.S.

West Haputale Estate,
Ohiya, Ceylon.

V.—DISAPPEARANCE OF JACKALS.

I should like to know whether cases of disappearances of jackals from an area or district have been recorded previously.

Jackals were very numerous up to three or four years ago in this part of the Coimbatore District lying on the Mysore Plateau, but appear to have almost vanished from these jungles. This is probably due to an outbreak of some disease, wild dogs for instance have been attacked by mange badly in the last year or two, but it is curious that their disappearance appears to coincide with the last stages of a very serious outbreak of rinderpest among village cattle which lasted for three years. Jackals naturally fed their full on the carcasses of cattle that died from this disease, and one wonders whether the jackals did not fall victims to a complaint brought on by a surfeit of stricken beef !

R. C. MORRIS.

Honnametti Estate,
Atttikan—Mysore P.O.,
South India.
September 12, 1937.

VI.—ON WHISTLING OF BISON.

In regard to the whisting sound made by bison (*Bibos gaurus*) mentioned by Mr. Biddulph in the last *Journal* this 'whistling' noise, or high-pitched wail, is always made by a *bull* during the breeding season months, October-November to February-March.

R. C. MORRIS.

Honnametti Estate,
Attikan—Mysore P.O.,
South India.
October 12, 1937.

VII.—CAUSE OF SORE NECK IN SAMBAR.

A circular bare and hairless patch on the throat of sambar has been the subject of controversy going on from 1921 under the caption 'Sore Neck in Sambar' in the *Journal* of the Bombay Natural History Society and readers of this valuable *Journal* owe the editors a debt of gratitude for allowing many sportsmen and writers to express their own views.

In this connection a note appeared in the *Journal* of the Natural History Society of Siam under the signature of Mr. P. R. Kemp. It was referred to in Volume xxxvii, No. 4, Misc. Note No. viii of the Bombay Natural History Society's *Journal* for the first time in 1921.

Although this subject is discussed in *Shikar Books* and in subsequent issues of the *Journal* of the Bombay Natural History Society in recent times, yet this phenomenon seems to have been observed for the first time, as early as 1890 by Mr. W. S. Thom (vide his interesting article in the *Journal* of the Bombay Natural History Society, Vol. xxxix, No. 2).

Before coming to the real cause for 'Sore Neck', it would not be out of place to summarise the opinion of various writers and tribes who live in forests where sambar abound. Mr. Kemp was told by the Siamese that this 'Sore Neck' is the leprosy of the Sambar and it is caused by the animal eating the fruit of the Ma-Kawk tree known as the wild olive or plum. The matter was referred to Mr. Dunbar Brander, I.F.S., who writes that he always observed this mark or sore during the period when hair and horn are undergoing a change. He naturally connected the two and came to the conclusion that the sore was the result of the changes taking place. He qualifies his remarks and states that this is merely his suggestion.

On reading the above notes, Lieut. R. A. H. McConnel states that while shooting in the Southern Province of Ceylon, he encountered a sambar hind which was incapable of movement. On examination he found that the under part of the neck was covered with festering sores. The hind was otherwise in fair condition and, as the sore was superficial, Lieut. McConnel supports the theory of disease. Here it may be mentioned that the sore neck due to a change in horn does not explain the phenomenon. (Vol. xxviii, No. 4, Misc. Note No. v, *Journal* of the Bombay Natural History Society.)

Then in Vol. xxviii, No. 2, Note No. ii appears the note from Mr. J. H. Hutton (now Dr. Hutton) with reference to 'Sore Neck'. He was told by Nagas that it is due to the animals perpetually rubbing themselves to get rid of ticks. Dr. Hutton adds that ticks certainly attack the necks of sambar but suggests that it may possibly be the result rather than the cause.

A further reference was made to the Honorary Secretary, Bombay Natural History Society through Mr. Blackburn and he very kindly supplied me with a reference to 'Sore Neck' in Mr.

Dunbar Brander's book *Wild Animals in Central India.* The author says that—

'In parts of India, especially towards Assam, Sambar have often been observed to have a curious sore bare patch or spot on the base of the neck. The cause is not known: it has been suggested that it is the manifestation of some disease. The phenomenon is not common in the Central Provinces, and I have only noticed it late in the hot weather or at the commencement of the rains. At this season of course Sambar are subject to little intelligent observation so it is possible that these spots exist more frequently than we are aware of. Occurring as they do in the region of a hair whorl or centre, and at a time when rapid moult is taking place, I have associated the phenomenon as being in some way connected with the new growth of hair. When Sambar change their coats they often do so in large tufts, the old hair coming away in sections before the new hair has developed. During this stage they have a very ragged appearance.'

In the publication of 15th April, 1937 of the Bombay Natural History Society's *Journal* (Vol. xxxix, No. 2) a very interesting article on this subject appears. This is 'The Malayan or Burmese Sambar' by Mr. W. S. Thom. In this article Mr. Thom not only explains his own theory and observation but adds the experience of other sportsmen and observers. At the instance of Mr. Thom, tubes were supplied by Mr. Mitchell to Mr. Mustill, the Game Warden, Burma to collect some of the exudation from the sore of the sambar, so that Mr. Mitchell may be in a position to make an attempt to diagnose the disease, if disease it is. Mr. Thom thinks that if the sore or circular patch on the sambar's neck is not the result of a parasite or a secretory gland such as is found in elephants, camels, black buck etc., then it may be the result of bites by ticks and the intense irritation set up by the animals pushing their way through elephant grass and under growth. Mr. Thom suggests that plants like *Mucuna pruriens* whose pods are clothed with intensely irritating bristles, stinging nettles and the fine hairs of the bamboo set up irritation, and he adds that when sambar push their way through grass and tick-infested jungle, the animals hold their heads well up and these insects then find the throat and neck the most convenient spot on which to gather. Mr. Thom writes that he has been told that 'Sore Neck' has been seen on the necks of brow-antlered deer and in one instance, on the neck of a barking deer.

Captain S. R. Rippon informs Mr. Thom that skin on the bare patch on the tame sambar's neck appeared to be quite normal, i.e., there was no sign of any parasitic disease to the naked eye nor did it appear as if the hair had been lost by rubbing. Captain Rippon thinks that the bare patch is probably a normal characteristic of the species and he doubts whether the sores are due to rubbing. He states also that it certainly would seem to be too much of a coincidence to find only this area on the neck affected in the way in every case, ticks must be found on other parts of the body.

Mr. Thom gives further very interesting facts from Major C. P.

Evans' book *Big Game Shooting in Upper Burma.* This is quoted below :—

'Major C. P. Evans in his book *Big Game Shooting in Upper Burma* has a lot to say on the subject of the sambar sore, *vide* pp. 144-48 of his book, but I will only quote a few extracts. He says that the Burman and Indian Shikaris state that the sambar is attacked by a parasite (I doubt whether they could explain what a parasite was) and that the sore is caused by the animal rubbing itself to get relief from the irritation. This he says no doubt is true so far as it goes; but they are quite unable to explain why sambar should invariably be attacked in exactly the same place or why the sore should be as circular as if it were made by a pair of compasses, and why sambar alone of all deer should be so afflicted. But are sambar the only deer so afflicted. Haven't black buck in India got it? Evans goes on to say that he does not himself believe in the rubbing theory. If the beast rubbed itself against a tree or branch to get rid of the irritation it would do so with an up and down motion and the result would be irregular scratches along the throat. But strange to say in spite of the forbidding appearance of the sore sambar do not appear to be at all inconvenienced by it. Evans says that he has watched sambar, when out in the open both in India and Burma for half an hour or more at a time, on purpose to see whether the animals rubbed the sore; but he never saw any sambar whether young or old pay the slightest attention to it. That the disfigurement is caused by a peculiar parasite which only attacks the sambar is according to Evans quite certain; but why it should invariably confine its attentions to the throat, or why it should cause a complete circular sore and, having done so, desist from further attack he is unable to explain. Judging by the bleeding spot in the centre of the circle it looks, according to Evans, as if the parasite having reached its limits, returned to the original spot and fed there, since it is, in full-grown animals, always quite raw, the remainder of the circle being merely bare and pink-looking. Seen in the early dawn this raw spot has quite a gruesome appearance.'

The writer of this article has seen several sambar at close quarters during the course of 20 years of his roamings in the jungle, but has never seen a single specimen of sambar with a 'Sore Neck' and never attempted to wait and watch for sambar as Major Evans did.

Though there are several sportsmen and scientists in the field, seeking to *unravel* the mystery of this phenomenon, for the last 20 years, the writer had an uncommon bit of good luck to read a passage in a small book which explains the cause of 'Sore Neck' in such a manner that it leaves no room for any doubt.

The fact of the matter is, our jungle friend the sambar although sometimes described as 'Monarch of the Dale' does not carry 'blue blood' in its veins. He has much humbler origin than people think. This 'Sore Neck' is nothing but a badge of inferiority complex which sambar and other higher forms of animals carry round their necks to remind them for all time, that they were once marine animals. When the Himalayas were under water, these animals including sambar perhaps were swimming in the shallow sea.

In the biological language, 'Sore Neck' in sambar is an insistence of 'Atavistic Degeneracy', i.e., a return to an ancestral type. What we see as a bare patch and a sore on the neck of the animals used to be a place where gills were attached when these animals were leading a marine life. The disease is called 'Cervical Fistula'. I recommend the readers to study Mr. B. Lindsay's book *The Story of Animal Life.* I now quote the relevant passage from this book.

'Nor do we need to go into the nursery to find links with our inferiors. Much, indeed far too much, has been written of late years about "atavistic degeneracy"; that is to say degeneracy which imitates the characteristics of our forefathers. Many things which are classed as diseases, whether of the body, mind, or moral nature, may be explained in this way. Take the gills, which, as we have stated, exist in all vertebrates, but not in the adult of the highest groups. In a sickly individual, even among the highest vertebrates, traces of these are sometimes seen existing in the adult, as a gap or open space in the neck called by the medical man "cervical fistula": this is an instance of degeneracy in the body. Take, for another instance, the kleptomaniac, who snatches up everything he takes—a degeneracy of the mind, a relic of savage nature out of place in civilised man. Yet the gill-space is an ancestral feature which has its right time to appear though it is out of place in the adult; and the "want-to-snatch" stage, as we have already seen, is quite natural in the young child.'

To understand clearly the development, position, and modification of 'gills' in the modern animal, I quote another passage from Mr. Lindsay's book.

'The classes of the Vertebrata are Fishes, Amphibia, Reptiles, Birds and Mammals. We used to learn that of these, fishes had gills, and Amphibia gills for a time; but, to be strictly accurate, we must say that fishes have gills, and all the rest of Vertebrata have gills for a time. There is no exception to this rule, not even among the highest vertebrates. But in those vertebrates which stand higher in the scale of life than Amphibia, viz., Reptiles, Birds and Mammals, these gills are never brought into use. They only exist in the early embryo, and afterwards disappear, giving rise by their modification to other structures.

'Strange to say, one of these structures is the ear. This takes its origin from one of the gill-"clefts" or spaces. The Eustachian tube, which communicates between ear and nose, is part of this cleft; and the little bones which are inside the ear represent the bones of the gill-cleft. For, in fishes, bones support each gill, and are connected together to form a complex arrangement. In the higher vertebrates, which possess gills only in the embryo, this gill-skeleton is much modified, and persists as a bone, the hyoid bone, supporting the tongue.

'The gills of vertebrates, arranged in successive pairs along the throat, are "perforating gills"; that is to say, they consist essentially of holes or spaces which pass right through the wall of the throat.'

JAGDALPUR, S. R. DAVER.
BASTAR STATE.
October 7, 1937.

VIII.—SOME BIRDS OBSERVED IN KUTCH AND KATHIAWAR.

From the ornithological point of view Kutch appears to be one of the least known of our Indian provinces, and Lester's *Birds of Kutch* is the only reference work to it that I can trace. A few notes jotted down during two short week-end visits (mid-June, 1936 and mid-August 1937) may be of interest.

At Bedi Bunder in Kathiawar, a curlew was seen on 12th June. Lester cites a local sailor to the effect that curlew breed on the islands in the Gulf. At Rozi Bunder (also on the Kathiawar side), curlew and whimbrel were both common on the 16th June. Again in mid-August this year, both species were plentiful in the mangrove swamps around Kundla. Judging from the arrival and departure of these birds round Bombay, however, my notes alone would not justify a belief in the breeding of these birds in India. Further information on this point would be interesting.

At the Hemisa Tank in the heart of Bhuj, I saw a solitary drake cotton teal (*Nettapus coromandelicus*) in full plumage.

This is apparently the first record of this bird in the State. Subsequent to this I learnt from Prince Fatehsinghji of Kutch (who is taking a keen interest in birds) that two more had been obtained at a recent shoot and their identity confirmed in Bombay.

I was also fortunate enough to meet during my short visit, a pair of those rare and elusive birds, the white-winged black tits (*Parus nuchalis*) on a scrub-covered hill-side. Unfortunately I had no occasion to add anything to our knowledge of this little-known bird.

Other birds seen, apparently rare in Kutch (vide Lester) were the two Jacanas (*Metopidius* and *Hydrophasianus*) both of which were common at the Hemisa Tank in June. The Crow-pheasant (*Centropus sinensis*), which Lester particularly notes as absent in Kutch, was seen at Jamnagar, just across the Creek.

ANDHERI, SALSETTE, HUMAYUN ALI.
BOMBAY.
December 15, 1937.

IX.—DRUMMING OF WOODPECKERS.

Anyone who lives in or near the jungles of this continent is familiar with the peculiar rat-a-tat or drumming on dead trees, a performance so often heard but not so often seen. I have the good fortune to have a vocation which permits of a study of bird life and situated where woodpeckers abound After a number of years witnessing these performances I am still at a loss to account for the reason therefor.

A woodpecker will fly to a dead tree which is often used time and again for this purpose and after sitting still for a short while will peck rapidly with ever quickening strokes of its bill at the bole or branch of the tree selected. It will keep up for some time with regular intervals between each bout of drumming the while looking round as if expecting something to turn up in response, but I have never seen any other of the species attracted in this manner so it would not appear to be a mating call. In any case why should a bird with usually loud vocal call go to the trouble of wasting its energy, tapping against trees to attract the female? It seems to be a practice common to all types of woodpecker and even those allied species which cannot be called true woodpeckers such as the Piculets. The other day I was attracted to a dead Grevillea tree by a persistent br-r-r-r, br-r-r-r sound at regular intervals and saw up at the top a Nilgiri Speckled Piculet performing.

I give a list of the various woodpeckers I have observed drumming.

Southern Golden Backed Woodpecker, Malabar Golden Backed Three-toed, Malherbe's Golden Backed, Malabar Heart-spotted, Malabar Great Black Woodpeckers and the Nilgiri Speckled Piculet.

It would be interesting to hear through the medium of the *Journal* others' observations on this subject. I note that Whistler mentions that it apparently is an outlet for sexual emotion though he does not support it with any reasons why it should be.

NADUAR ESTATE,
VALPARAI P.O.,
SOUTH INDIA.
December 12, 1937.

R. N. CHAMPION-JONES.

[The vocal or instrumental music of birds though it has its origin in sex, cannot be interpreted as nothing more than an elaborate form of sex signalling. It may pass outside the immediate circle of sex relationship and become an outlet for such emotions as joy, fear, jealousy or even the expression of mere content. In an interesting article on the drumming of the Heart-Spotted Woodpecker (*Field*, November 20, 1937), Major A. Buxton, writing about the performance of the birds at the nest, says that little drumming took place while the birds were sitting, but when he first entered his hide to film the birds in the act of drumming, the hen, disturbed by the noise he made, hit the trunk of the tree a resounding bang and ran up it drumming for all she was worth. The writer says that for two or three days he could always make her drum by making noises in the hide or by getting some one to hang about near the nest, for it was simply 'a case of making her rather but not too annoyed'. But once the woodpecker became accustomed to these disturbances, she ignored them and ceased to demonstrate. What part if any the drumming of the woodpecker plays in the inter-relationship of the sexes is not known. Both sexes apparently indulge in the habit—but Major Buxton's note indicates that drumming may be a reaction to emotion not directly connected with the sexual impulse. It is interesting also here to include a comment by Mr. Eric Parker on Major Buxton's note published in the same issue of the *Field*. The series of cine camera photographs which illustrate Buxton's article record probably for the first time the movements of the woodpecker's head when drumming—movements too quick to be caught by the eye, the head of the bird during the process becoming as blurred as a fast spinning top. The photos reveal a rotatory movement—the beak of the bird, first pointing half left, next points directly at the tree and then reverts to the half left. Major Buxton holds the commonly accepted view that the sound is produced by the rapid striking of the bird's beak against the wood and he observed that the sound varied according to the state of the wood, being much softer on dead wood than on live, and even varying in intensity on different parts of the trunk according to the state of decay. Mr. Parker holds that the drumming sound of the woodpecker is not produced by repercussion but that it is purely vocal and emanates from the bird's throat. He submits that it would be impossible, with so small an instrument as the Spotted Woodpecker's beak, to produce by hammering on any sort of wood the long and sonorous volume of sound which can be heard more than a quarter of a mile away.—EDS.]

X.—THE INDIAN LONG-TAILED NIGHTJAR (*CAPRIMULGUS MACROURUS ALBONONOTUS* TICKELL).

The article on Nightjars contributed by Mr. E. H. N. Lowther to the *Journal*, Vol. xxxix, No. 3, is most interesting, made more so by the admirable photos accompanying it which illustrate the wonderful provision of Nature in self-protection.

The Indian Long-tailed Nightjar is quite common at Dehra Dun. During the hot weather it calls almost incessantly throughout the night. Deep and shady nullahs are features of this place, which are the resort of this bird. It so breeds in them.

About the 15th April 1919, I flushed a bird, in one of these, off a single egg. The nest was just a few leaves scraped together. I marked the spot most carefully, so as to make sure of finding it again. I returned to the spot on the 18th, and although I looked hard and carefully at the spot where I was certain the nest was, I could detect absolutely nothing, so I thought there was 'nothing doing'. I walked slowly towards this spot. When I had arrived there I stopped and with my stick I pointed to the place, practically between my feet, when up flew the bird, disclosing two beautifully fresh eggs. The point of my stick must almost have touched her before she moved. The protection afforded her by her colouration could not have been better.

LONDON, R. M. BETHAM, C.I.E.,
October 22, 1937. *Brigadier-General.*

XI.—ON THE PARASITIC HABITS OF THE PIED CRESTED CUCKOO [*CLAMATOR JACOBINUS* (BODD.)].

Three weeks ago I returned from leave to find many young Pied Crested Cuckoos about the station. Now both Mr. Stuart-Baker in the *Fauna* and Mr. Hugh Whistler in his popular *Handbook of Indian Birds* state that the young *Clamator* has that unpleasant cuckoo habit of pushing the other inmates or eggs out of the nest. In fact, Mr. Stuart-Baker enlarges on the habit by saying that, although at times many eggs may be found in the one nest, obviously the products of more than one female cuckoo, the strongest and first-hatched youngster alone survives.

Hume and Oates (*Nests and Eggs of Indian Birds,* 2nd Edition, page 388) only go so far as to say that 'as a rule' the young cuckoo is the only bird the foster-parents raise, and, on the same page, quote R. M. Adam as follows:—'On the 13th August I observed in a garden in Agra two young birds of this species—being fed by an *Argya malcolmi.* There was also a young *Argya malcolmi* with the party.'

On August 23rd, I saw a Jungle Babbler feeding two young *Clamator* seated close together on a buttress root of a pipal tree close to the door of my office. The babbler first fed one, flew up into the tree, returned almost immediately and fed the other one. It then flew off followed by both young cuckoos.

Two days afterwards I found we had a pair of young Pied Crested Cuckoos in our own garden, obviously just out of the nest. These were moving about together with a crowd of nine (at least) babblers, and are still to be seen together in the compound.

Now are these really cases of two young cuckoos being brought up in the same nest? If so, it would seem that this species is not so black as it is painted. On the other hand I have seen four members of a gang of babblers feed the young babblers in one nest, so it is faintly possible that these young cuckoos actually came from different nests belonging to members of one gang. I wonder if any other members of the Society have anything to say on this subject?

BAREILLY, R. S. P. BATES.
September 6, 1937.

XII.—EGG-LAYING OF THE KHASIA HILLS CUCKOO (*C. C. BAKERI*) IN THE NEST OF THE BURMESE STONE CHAT (*SAXICOLA CAPRATA BURMANICA*).

(May 1937).

Yesterday, May 19, 1937, I went for a walk with my wife and children at about 5 p.m. at Taunggyi, S. Shan States. Elevation about 5,000 feet. On our return we passed a ploughed field just outside my north field and some two hundred yards from my cottage. It was then about twenty minutes past six in the evening and the sun low. My dogs chased a bird off the plough, and then I noticed that it was a cuckoo. I stood there pondering when the cuckoo returned and perched on the bamboo rails. Two chats were after her, and so I suspected that they had a nest there, and that the cuckoo was going to lay. She then flew off with the chats after her—out of sight. We sat down to wait, and I got my field glasses ready. Back came the cuckoo and she flew low over the centre of the field, almost settling at a place some sixty yards in front of us. She then carried on to perch on the rails quite close to us. Then she flew back over the same area and carried on out of sight.

In a couple of minutes' time she came again with the chats after her and dipping low in flight she settled at about the place I suspected the chat's nest to be. I got my glasses on her, and though the light was failing a little, I could see her very plainly. She had the appearance of a laying cuckoo, being a female with her throat feathers puffed out and her crown feathers raised from time to time. She began to search for the nest, hopping about in an ungainly fashion from clod to clod stretching her neck up looking everywhere. The chats were now mobbing her furiously, causing her to be continually ducking to avoid their onslaughts. As she did this she opened her beak at them and made faces. She did not appear to know exactly where the nest was and began a systematic search for it in an area of about five yards by three. The clods in the field were very large and lumpy with all manner of holes and cavities to conceal a chat's nest in, so that she disappeared from sight from time to time as she hopped into the depressions. Backwards and forwards she went in a very persistent manner, mobbed the whole time. I should have perhaps driven her off and quickly erected a hide there, but it was getting so late and I did not know exactly where the chat's nest was myself. I decided to risk it and continued to watch her with the glasses in the hopes that she would be in sight when she found the nest. With luck I should then be able to see her lay.

She was, I think, *a full ten minutes searching* for the nest. It seemed to me a very long time. Her persistence astonished me. She really did not seem to know where it was as she frequently went to look into holes only to come out disappointed again. At last she dipped out of sight from me and a flutter of her wing tips suggested that she had found the nest and was in the act of laying. She was there just out of my sight for about six seconds—and then away she sped in a great hurry.

She had undoubtedly laid!

When she was about a hundred yards' distance she gave two or three times her bubble note.

We climbed the fence and walked up to the place, and there we found a very well concealed chat's nest of the inaccessible type. The exact situation of it was obvious to me from the cuckoo's feathers—six or seven of which were scattered about the nest entrance—mostly over it. As it was all soft earth thereabouts from recent rain her feathers must have been pecked out by the chats—both of which attacked her furiously at the time of laying.

By stooping down with my head a foot above ground-level I could just make out that the nest contained two eggs—the cuckoo's and one chat's egg. From the outside to the edge of the nest would be about three or four inches—that will be shown in the photograph. It was not a nest that I could get my hand into—although my hand is exceptionally small. By using just the tips of my forefinger and middle finger I was just able to get the cuckooo's egg out—and then after it, the chat's. One at a time and with difficulty. The cuckoo's egg was warm and quite dry—with that lovely mat bloom on it of an egg just laid. The chat's egg was whole and uninjured.

We went home with the cuckoo's egg, intending to photograph the nest next day.

This incident confirms in every respect my observations of last year. The actual egg-laying took about three seconds, if we allow three seconds for the cuckoo to put her head into the chat's nest to take out a chat's egg.

There were the usual preliminary flights to the vicinity of the nest to get her ready for her laying. The only thing that astonished me a little was that she really did not, on this occasion, seem certain of the exact situation of the nest but had to hunt diligently for it—for about ten minutes, and this proves that a cuckoo is able to retain her egg for ten minutes.

The laying took place at six forty—the sun just about to dip behind the hills.

A photo with measurements of the nest concludes my account of this incident.

T. R. LIVESEY.

May 20, 1937.

XIII.—CUCKOO PROBLEMS.

In regard to my paper 'Cuckoo Problems' published in Vol. xxxviii, No. 4 of 25th August 1936, an explanation is called for. The term I used to express my theory of the evolution of parasitism in the Cuckoos and the final adaptation of their eggs was 'Desire'. That was perhaps an unfortunate term to use, as it suggests a sudden and independent volition on the part of the cuckoo amounting to almost conscious reasoning. Many people have given it this meaning, and so completely misread me, in spite of my having fully explained that my 'desire' was an *inherited* desire.

I must therefore explain that 'desire', has to be read as an 'inherited urge to parasitism' in most places where it occurs.

TAUNGGYI, T. R. LIVESEY.
SOUTHERN SHAN STATES,
BURMA.
October 13, 1937.

XIV.—OCCURRENCE OF THE BLACK-CAPPED KINGFISHER [*HALCYON PILEATA* (BODD.)]. IN THE GONDA DISTRICT, U.P.

I am sure you will be both surprised and interested to hear that a specimen of the Black-capped Kingfisher (*Halcyon pileata*) was caught alive in the garden next to mine this morning. It was found to have a very badly broken wing and I think it must have struck the electric light wires in its flight and so got its wing broken. According to the *Fauna of British India,* it has not, with one exception, been known further west than Monghyr on the Ganges and what it was doing up here, I fail to surmise. I have been in the stretch of country from Purneah on the east to Cawnpore on the west for the past 14 years and am always on the watch for birds, but I have never seen this species before. I shall be glad to know if it has ever been recorded from these parts previously, if not, its occurrence here may be of sufficient interest to warrant publication in one of the next issues of the Society's *Journal.* Beyond its broken wing, the bird is in beautiful condition, but I can only get it to eat with difficulty.

Bargaon P. O. W. A. HEWITT.
Gonda, U.P.
September 25, 1937.

[In India the Kingfisher is found in forests along the coasts and in the banks of tidal rivers, following these practically up to the hills. Its occurrence in the Gonda district, U.P. is unusual. The bird in question was probably a straggler from its normal habitat.—Eds.]

XV.—ARRIVAL AND STAY OF SNIPE IN ASSAM.

I have read with interest the note on 'Early and Late Snipe' in Vol. xxxix, No. 4 of the *Journal* which I have just received and on turning up my Game register I find the following information which may be of interest :—

(1) In the Rajshahi District in Bengal during the season 1931-32 the first snipe I saw were three birds on the 19th August, but they were very wild and I failed to secure any. I saw another bird on the 25th August, but this also eluded me. It was not until the 30th August that I actually bagged one. Unfortunately I kept no record as to whether it was a Fantail or a Pintail. In the Game Book at the Police Mess at Sardah in the same district the earliest recorded snipe shot was on the 29th August up to the year 1930. The Game Book goes back a number of years.

The latest snipe I secured in this district in this year was on the 3rd April when four couple were bagged all of which were Fantails; but a Pintail was shot by a friend who was shooting with me on the same date. He also got three Fantails.

(2) In the Sylhet District of Assam during the season 1932-33 the first snipe I saw was on the 25th August and I shot it. It

was a Pintail. I know of another Pintail shot in the same district the same year on the 13th August. Snipe have been heard of in Sylhet at the end of April.

(3) During the season 1935-36 in the Sadiya Frontier Tract of Assam I shot a Fantail on the 8th August and a further eight couple Fantails on the 21st August.

(4) In the same District (Sadiya) during 1936-37, I saw a snipe on the 19th August but failed to secure it. I bagged a Pintail on the 20th August, two more on the 21st August and a further 3½ couple Pintails on the 22nd of the same month. Snipe do not appear to stay late in this District and I know of none shot after March. I feel certain however that the first birds reach the district at the end of July for all the birds shot in August have shown no signs of their long journey southwards being in very good condition and very lively. It is interesting to note that, whilst in August 1935 all the first birds shot were Fantails all the first birds shot in 1936 were Pintails!

Further information as to the first arrivals and the latest recorded snipe particularly from areas just south of the Himalayas would be interetsing.

GAUHATI, R. E. PARSONS,
KAMRUP DISTRICT, ASSAM. *Indian Police.*
December 31, 1937.

XVI.—OCCURRENCE OF THE SHELDRAKE (*TADORNA TADORNA*) IN MURSHIDABAD DISTRICT, BENGAL.

It might be of interest to record the occurrence of the Sheldrake (*Tadorna tadorna*) in district Murshidabad, Bengal, a small party of some 5 or 6 of the birds having been seen by a friend and myself on a piece of open water on December 5th 1937. The Sheldrake which were observed at about 100 yards' range through field-glasses were not mixing with the numerous other ducks on the water (mostly Pintail) but formed a small party of themselves near the edge. I understand this species is a somewhat rare visitor to this part of India.

Another fairly interesting occurrence of this season in the same district the Mallard (*Anas platyrhyncha*), two having been obtained on November 21st and one on November 28th, others having been seen on both days.

1, CLIVE STREET, R. J. CLOUGH.
CALCUTTA,
December 17, 1937.

XVII.—NOTE ON THE PYTHON.

A few days ago I obtained a python near a small 'busti'. The reptile was said to have caught and swallowed a goat the previous afternoon, at the edge of a paddy field, and had moved a distance of only about twenty-five yards into thick undergrowth, to sleep off the effects of its rather large meal.

In order to lighten the carcase for easy transport to my car, and also so that the owner of the goat might regain his lost property, (for he was of the opinion that it would still be quite good to eat), I opened up the snake and removed the goat, which latter was incidentally a large one and quite above average size. The goat had been swallowed head foremost and rather more on its back than side, as the sharp points of the horns could be seen in the tightly stretched belly skin of the python. Digestion had only slightly commenced round the head and neck, where some of the hair had gone, and the bare skin had turned a dark colour. This was at 11 a.m. and if my information was correct, about 19 to 20 hours after swallowing. (Pretty slow digestion!) With the exception of this discolouration the goat was absolutely intact, no wounds were visible and no bones appeared to be broken. The python was not a large one, measuring a bare 14 feet 6 inches.

The few books in my possession that mention this subject, would have one believe that the python crushes its victim into a sausage-like mass before swallowing, but in this instance the crushing process had certainly not taken place. Even the legs were unbroken, the fore ones doubled back, and the hind ones *forward,* under the belly.

Questions that seem to need answering, are:—(1) How was the goat killed without wounds being inflicted, or bones broken? (2) How did the hind legs assume the position mentioned above? (3) Why were the usual signs of crushing entirely absent? Is it possible that the goat was swallowed alive, and therefore died of suffocation, thus accounting for the lack of wounds and broken bones, and also the position of the hind legs, in that they were caught in this position by the jaws of the snake during its (the goat's) death struggles? Finally, would a python of this size find the goat small enough to make crushing unnecessary, and only employ this method on larger animals?

It would be of great interest to know if the natural feeding habits of the python have been accurately observed, and also how such an apparently sluggish snake is able to catch wary creatures like wild pig, and barking deer, as they undoubtedly do.

Since writing the foregoing I have discussed the matter with a friend, who is a very keen observer with long experience in Assam, and I quote with his permission, two out of many instances that go to prove his contention of the habits of the python, in obtaining its food.

It is his opinion that the python waits beside a path used by domestic animals or game, near a tree stump or sapling that offers an anchorage for his tail, and lies (perhaps for days), with the fore part of his body in the form of an 'S'. When the unsuspecting victim comes along, this 'S' is straightened out with lightning-like rapidity, and the snake using its head as a battering ram, delivers a blow that 'knocks the wind out' of the animal, if not actually killing it on the spot. It then throws its body upon the animal, and using the purchase of its tail from the convenient stump or sapling, presses down with terrific force until life is extinct.

In support of this; in each of the two instances mentioned above, a goat was killed by a python, but the reptile was disturbed before swallowing had commenced. In each instance the animal had been killed with no apparent wounds, on a pathway. Again, in each case there was a tree stump or sapling nearby, and from the latter a definite impression of the snake (described by my friend, as resembling a small trench), leading towards the pathway, of about the right length to allow of a turn of the tail round the stump, with the 'S' formation at the head end, within striking distance of the path.

My friend, on both occasions found the reptile lying up just where his experience had led him to expect it, and in the attitude described above. He also mentioned that both goats were found with the eyes wide open and a placid expression, giving no indication of having died in great pain or fear.

Tinkong Tea Estate, A. J. YANDLE.
Tinkong P.O.,
Assam.
November 4, 1937.

[Snakes being limbless invariably seize their prey with their jaws : but the teeth of snakes are fragile and ill-adapted to hold a struggling animal; movement of the prey is arrested either, with the paralysing effect of poison, or, when this is insufficient or wanting, the snake holds its quarry still by encircling it with its coils. Boas and Pythons deal with their prey according to size. Invariably the victim is seized with the jaws. It is a question of actual seizure; not merely of knocking the animal over with a battering blow of the head. The mouth and head of a python are not built for such usage. When seized in the jaws, if the prey is small and makes no struggle the snake does not attempt to wind its body around it but proceeds to swallow it. Frogs and lizards are frequently swallowed alive and have been rescued little the worse for their experience. If the prey is bulky or struggles, the coils are brought into use to stop movement. There is no intention to crush or break bones, and this seldom happens. The extent to which the quarry is encircled and the amount of pressure exerted is proportionate to the struggles of the victim. But the vice-like grip of the snake, preventing expansion of the lungs or the muscular action of the heart, results in killing the prey by asphyxiation. This explains why in the incident described above the goat was without wounds. The teeth would make little apparent impression on a hairy animal, and why there were no bones broken or apparent signs of crushing—death was brought about in the usual way by asphyxiation; the position of the hind legs was merely incidental to the manner of seizure in the coils of the snake. The python's method of attack both under conditions of captivity or in the wild state has been frequently observed. The snake may make its seizure on the ground. In forest country it may climb into trees, where it hides so securely that even so alert a creature as a monkey is frequently taken unawares and meets its death, or the snake, with the help of its prehensile tail, suspends itself partly from the branches like a great aerial root, and from this position strikes at the unsuspecting quarry passing below. The element of surprise is part of the attack and the prey is seized and enmeshed in the coils before it is able to realise what has happened.—EDS.]

XVIII.—AN INSTANCE OF 'VIVIPARITY' IN *MABUYA CARINATA* (SCHN.).

Malcolm A. Smith[1] in describing the habits of *Mabuya carinata* says 'It is usually stated that this skink is viviparous, but such is not the case. A female kept by Father Dreckmann in captivity laid twenty-three eggs; from another female he recovered twenty-two eggs. All are about the same size—about 13 by 8 mm.; none of those examined showed any trace of embryo'. My observations show that *Mabuya carinata* is ovoviviparous. Some years back I came across, one morning in a school garden, a partly mutilated skink. On opening the body of the animal I found a number of eggs all of which showed developing embryos. I could observe closely the heart beat and circulation of blood. The stage of development roughly corresponded to a three-day-old chick embryo. Two of these embryos which I stained and mounted are still with me.

Subsequently I came across a case of oviparity in a skink in Annamalainagar. The egg clutch is now in the Zoology Laboratory of the Annamalai University.

ANNAMALAI UNIVERSITY, R. V. SESHAIYA,
ANNAMALAI NAGAR. *Lecturer in Zoology.*

XIX.—A SUPPLEMENTARY LIST OF THE PYRALIDAE OF CALCUTTA.

Some time back (*Journ. Bomb. Nat. Hist. Soc.*, xxxviii, p. 204) I recorded 91 species of Pyralidae taken in Calcutta. One species, *Ercta elutalis,* Wlk., must be deleted from this list, the specimen in question being a particularly pale example of *Ercta ornatalis,* Dup., and two species, *Ramila marginella,* Moore and *Ceratarcha umbrosa,* Swinh. must be corrected to *Ramila acciusalis*, Wlk. and *Phryganodes analis,* Snell.

I now add a further 33 species, bringing the total to 123 to date.

Mucialla rufivena, Wlk.
Crambus atkinsoni, Zell.
Platytes argentisparsalis, Hmpsn.
Scirpophaga bisignata, Swinh.

---

[1] *Fauna of British India Reptilia and Amphibia* (Vol. ii) by Malcolm A. Smith. (New series.)

Epicrocis aegnusalis, Wlk.
Hypsipyla robusta, Moore.
Etiella zinckenella, Treit.
Orthaga euadrusalis, Wlk.
Endotricha decessalis, Wlk.
Endotricha ruminalis, Wlk.
Stemmatophora pallidella, Hmpsn.
Herculia tenuis, Btlr.
Nymphula foedalis, Guen.
Nymphula responsalis, Wlk.
Nymphula affinialis, Guen.
Cataclysta fuscalis, Hmpsn.
Oligostigma picale, Guen.
Mabra eryxalis, Wlk.
Zinckenia perspectalis, Hbn.
Syngamia abruptalis, Wlk.
Bocchoris rotundalis, Hmpsn.
Bocchoris onychinalis, Guen.
Bocchoris inspersalis, Zell.
Bocchoris artificalis, Led.
Caprinia conchylalis, Guen.
Deba surrectalis, Wlk.
Lygropia amyntusalis, Wlk.
Pachynoa pectinicornalis, Guen.
Pachyzancla phoeopteralis, Guen.
Pachyzancla aegrotalis, Zell.
Phlyctaenodes massalis, Wlk.
Pionea ablactalis, Wlk.
Pyrausta phoenicealis, Hbn.

LONDON. D. G. SEVASTOPULO, F.R.E.S.
November 20, 1937.

XX.—A NOTE ON THE LYCAENID BUTTERFLY *EVERES DIPORA* (MOORE).

(*With a plate*).

During the warmer months (April-September) this delightful little butterfly may be observed in suitable localities between 3,000 ft. and 6,500 ft. in the Simla Hills. It is usually found in open grassy country about which the food plants grow.

In the summer of 1936, I observed the females ovipositing on the leguminous plant *Desmodium parvifolium*. I took some of the eggs but due to the withering of the plant I had no success with the larva.

This year I was surprised to see a female laying her eggs on another plant, *Flemingia fruticulosa* which also belongs to the *Leguminosae*.

A few eggs were collected from time to time and, with the latter plant (see photo of larva), kept in glass-covered tin entomological boxes (which method I would stress keeps the contents of the box perfectly fresh for a week) and several larvae were in due course reared to maturity.

It was interesting to note that the larvae were dimorphic, one brown with self-coloured longitudinal stripes, the other green similarly marked. These were separated, the green in one box, the brown ones in another box, but the pupae were all cream-coloured and the imagoes, irrespective of sex showed no differences.

During the lifetime of the larva it is seldom seen feeding, as this it does entirely on the tiny immature flower buds enclosed by the folded bracts. Pupation also took place in the same safe situation. So that altogether the species is more or less immune from the attacks of would-be enemies.

The sculpture of the egg is much the same as that of *Lycaenopsis huegelii* but is smaller and, whereas the latter's is dead white, this is sea-green.

Pupation lasts nine or ten days; the imago emerges between 10 and 12 a.m.

It would appear that the ants do not enter into the economy of this species.

In conclusion I would like to express my grateful thanks to Col. E. A. Glennie for photographing the specimen.

2, THE MALL, SIMLA. A. E. JONES.
November 3, 1937.

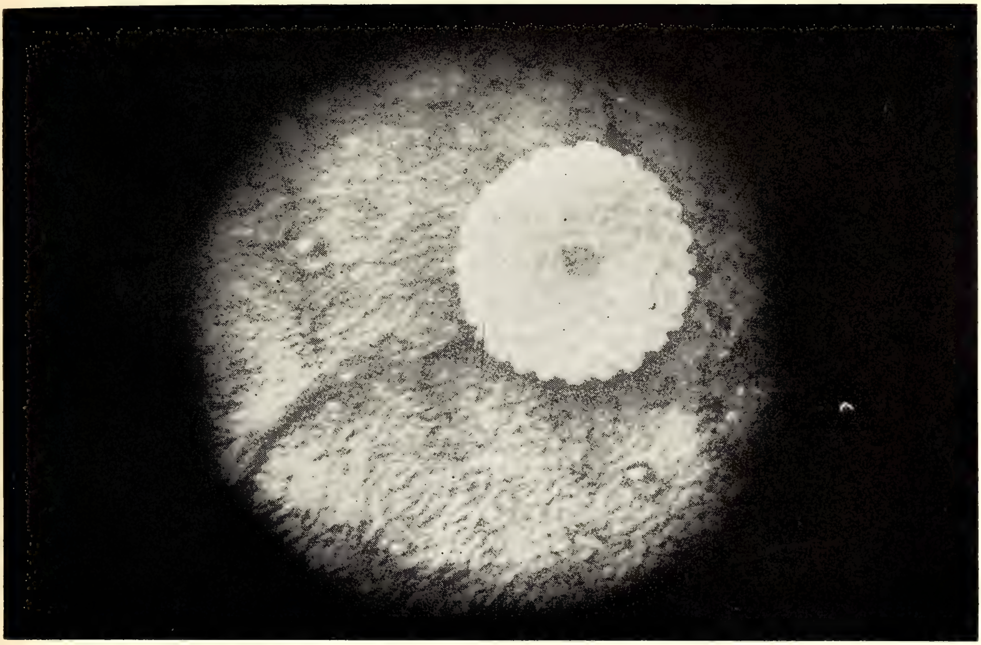
XXI.—ON THE DIFFERENCES BETWEEN *LYCAENOPSIS HUEGELII HUEGELII* AND *LYCAENOPSIS LADONIDES GIGAS*.

(*With a plate*).

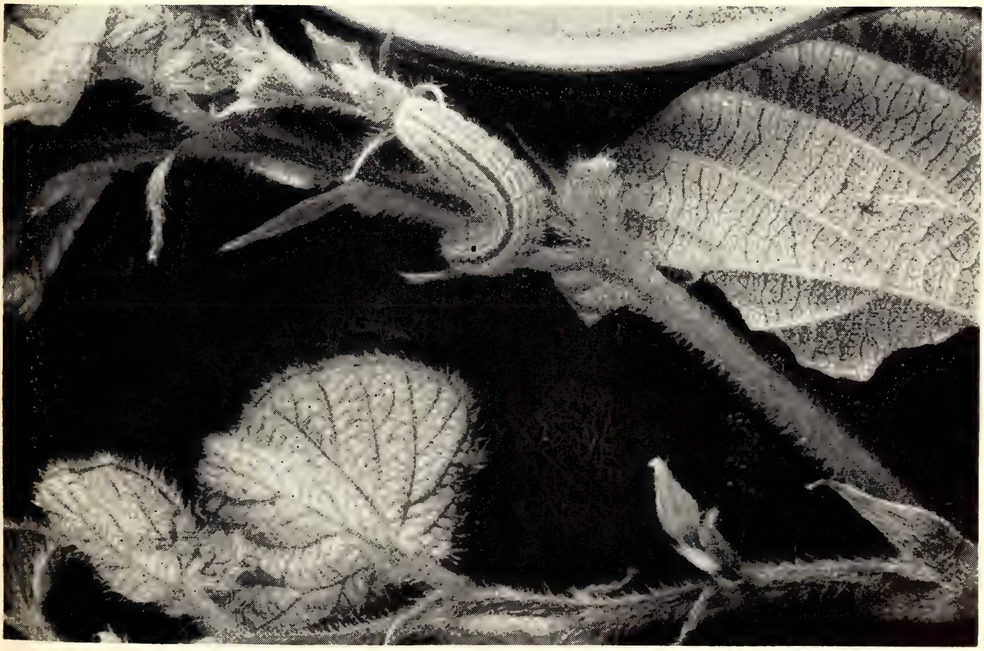
When Brigadier Evans' *Identification of Indian Butterflies* was published in 1927 there was no mention of the latter species, so when the second edition of this very admirable work appeared in 1932, with many additional species included, entomologists in India awoke to the fact that still more intense investigation might be profitably spent on solving some of the problems presented.

The above two species are to the casual collector of Lepidoptera very much alike in the imago stage. Last year, I told Brigadier Evans I had been breeding some of these from larvae; he suggested that further experiments in this direction would be useful. This year more larvae were collected but it was difficult to separate the two species from these and the credit of solving the problem is entirely due to Col. E. A. Glennie who, while hunting for larvae, came across numbers of eggs and herein were found the great differences which will be observed by reference to the photographs. From these eggs, duly separated into their respective boxes, a number of larvae were reared and the imagoes eventually emerged, some were bred by Col. Glennie and some by myself and all came out true to species as discriminated in the egg stage.

From the time the pupa was formed eleven days usually elapsed before the imago emerged.

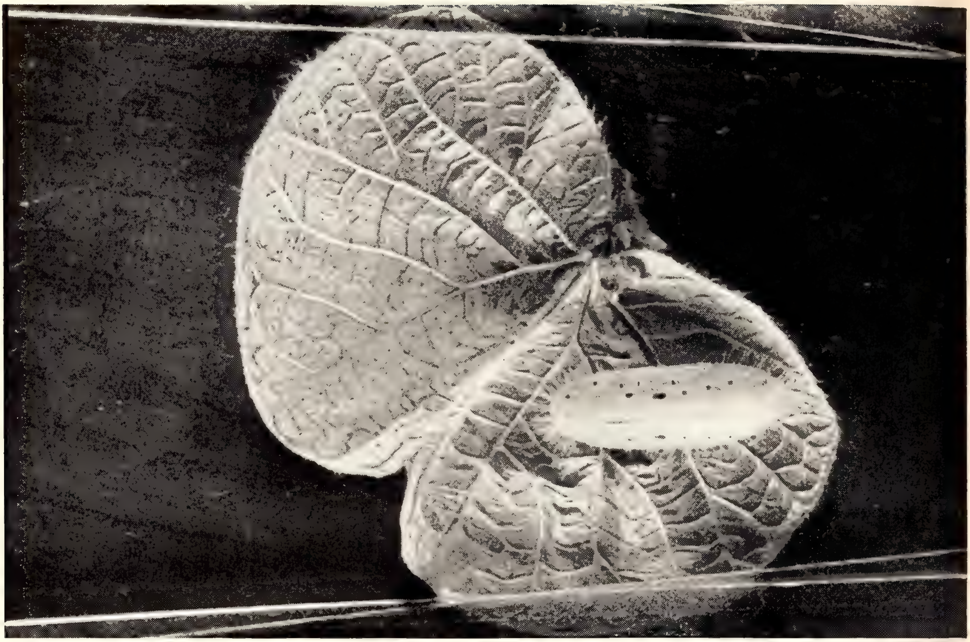


Ova × 40

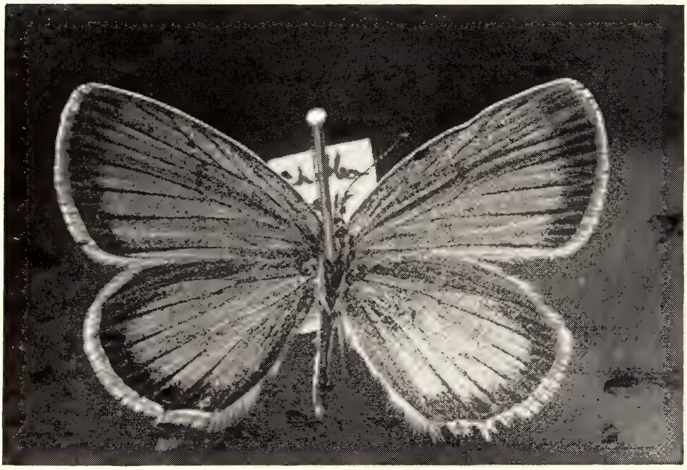


Larva × 3

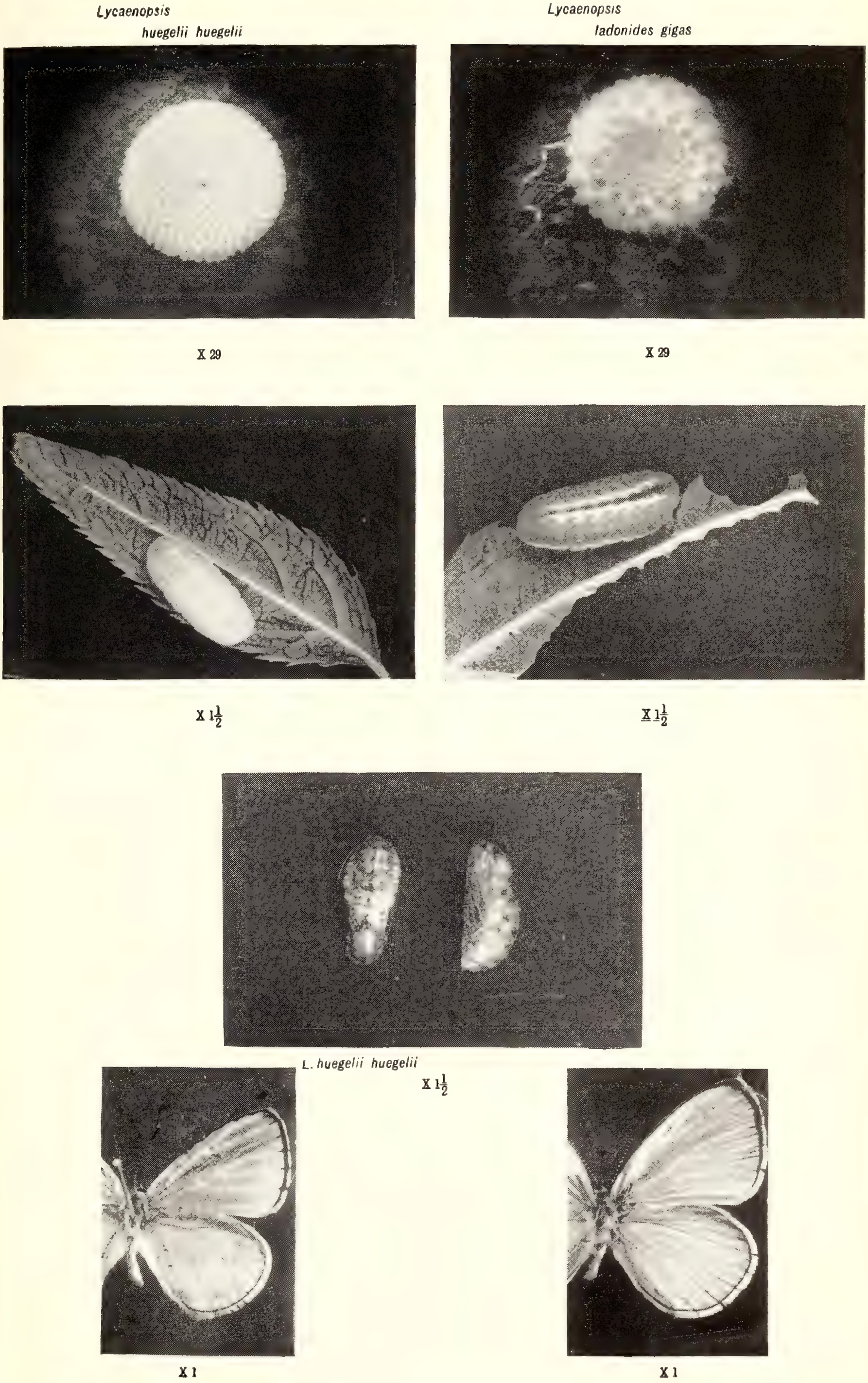
Stages of *Everes dipora,* Moore.



Pupa ×4



Imago, ♂ ×3
Stages of *Everes dipora*, Moore.


Lycaenopsis
huegelii huegelii
Lycaenopsis
ladonides gigas
X 29
X 29
X 1½
X 1½
L. huegelii huegelii
X 1½
X 1
X 1

Comparison of
Stages of *Lycaenopsis huegelii huegelii* (Left) and *Lycaenopsis ladonides gigas* (right).

From the photographs the respective larvae look distinct enough, both are green of various shades, the heads only being black. The only difference, as the camera depicts, is that the markings on *ladonides gigas* are somewhat clearer than those of *huegelii.*

The food plant is *Prinsepia utilis,* Royle, Order Rosaceae, a shrubby spiny bush attaining to a height of usually 4 to 5 ft. common in the Simla Hills from about 5,000 ft. to 7,500 ft.

Ants have not been observed attending either of the above species so far as we can ascertain.

2, The Mall, Simla. A. E. JONES.

XXII.—A NOTE ON OUR YALA SANCTUARY.

On May 5th my wife and myself had the pleasure of taking Sir Thomas Comyn-Platt to the wild life Sanctuary at Yala, so that he could get a 'glimpse' and an idea of that lovely country and see, if possible, some of our bigger fauna before his return to England after his visit to the F.M.S. where he was sent to obtain first-hand information for the Society for the Protection of the Fauna of the Empire.

Our visit was very hurried but fortunately conditions were good and this note may be of interest to those who contemplate a visit to this splendid, and the best Sanctuary in Ceylon, before it may be too late.

I knew it would be impossible to attempt it in our own car, but we were fortunate in finding a very ancient Chevrolet at Tissamaharama, which is the last jumping off place and which is some 30 miles from Yala, where the Ranger lives, and where the Sanctuary starts at the other side of the river, the Menik Ganga.

How that old car and the owner driver did that frightful journey would be a surprise to many. It is only a cart track and an apology at that. Every single obstacle where anyone else would have slowed down, or even stopped and got out, our driver simply charged at and over tree stumps and boulders we flew, only twice sticking in very deep and dry sand, where combined efforts of the party made the 'modern' Ship of the Desert continue its weary way.

What propaganda for the make of Chevrolet cars !

The track is only possible for only some makes of cars, during the dry season, which of course is not the best time to see the country at its best or to expect to see very much of all the wild life it holds. One heavy shower of rain, and one might be held up or cut off for many days. Therefore a car is not advisable, and the usual method of travelling in the little bullock carts is the best. The first miles are not very interesting although parts are beautiful open park-country and huge salt pans, like Daytona Beach.

After Palatapana, where the Game Reserve starts, the country soon becomes more interesting and very soon we began to see game, deer, buffalo and wild pig. Many of the deer simply stood and stared at our passing, or tried to race the car.

Reaching Yala at 9 a.m., rather late, we crossed the river where in future, it is hoped, there will be a boat or a canoe or a raft, as I have recommended for many years. This river very often suddenly comes down in flood when it would not be possible to cross without a boat. Some of my men have been cut off and have had to spend the night up a tree and in heavy rain, simply asking for death by malaria. A raft would be a simple matter and easy to make, but progress moves so slowly!

It was very hot and rather late in the day when we reached the first huge open plain, but still we were lucky in being able to show Sir Thomas many buffalo, deer, pig, etc. while a bear ambled across our path, disturbed in its feeding on the delicious ripe palu fruit, which taste like small fresh dates and are very refreshing and said to be intoxicating, but we noticed no such effects.

On our return a cup of tea with the Ranger was most welcome, when one of the men suddenly called out 'Elephant'. This was luck, and from the small bungalow compound we could show our visitor a fine large bull slowly wandering about the river bank. If we had tied up a tame one, it could not have been arranged better!

It was a pity that time was all too short, as a few days camped in the very heart of the Sanctuary is an experience one never will forget.

The camp-site is on a huge plain under some large shady trees, and from one's camp chair or even camped, one sees the whole plain covered with wild life, practically throughout the whole day except during the hot noon hours. Herds of deer, small lots of sambhur, hundreds of buffalo, many fine lone old bulls, sounders of pig, jackals, peafowl, numerous waders and storks, and often a lone—or some herd elephants. It is an experience few would believe one could find in this world, where Nature and Wild Life are pushed back more and more by our unwelcome and destroying 'civilisation'.

Intending visitors should remember that permission to visit this Sanctuary must be obtained from the Minister for Agriculture in Colombo, while any information as how to arrange such a trip and make all the arrangements, will be gladly given by the writer of this note.

It must be remembered that when the Yala Wild Life Sanctuary has been declared a Strict Natural Reserve, permission to visit it will be most difficult, if not impossible, to obtain. Personally I think that a great mistake, I know that country very well, and I cannot possibly see what harm it could ever do for a small party to visit it and camp there a few days. That cannot disturb the game or the wild life in any way whatsoever, and it will be a sad day if that glorious country will be closed for ever for those who are genuinely interested in wild life and who love beautiful country so little known.

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THE EDITORS MUCH REGRET THE DELAY IN THE PUBLICATION OF THIS NUMBER OF THE JOURNAL; THIS WAS UNAVOIDABLE OWING TO LABOUR TROUBLE AT THE PRESS.

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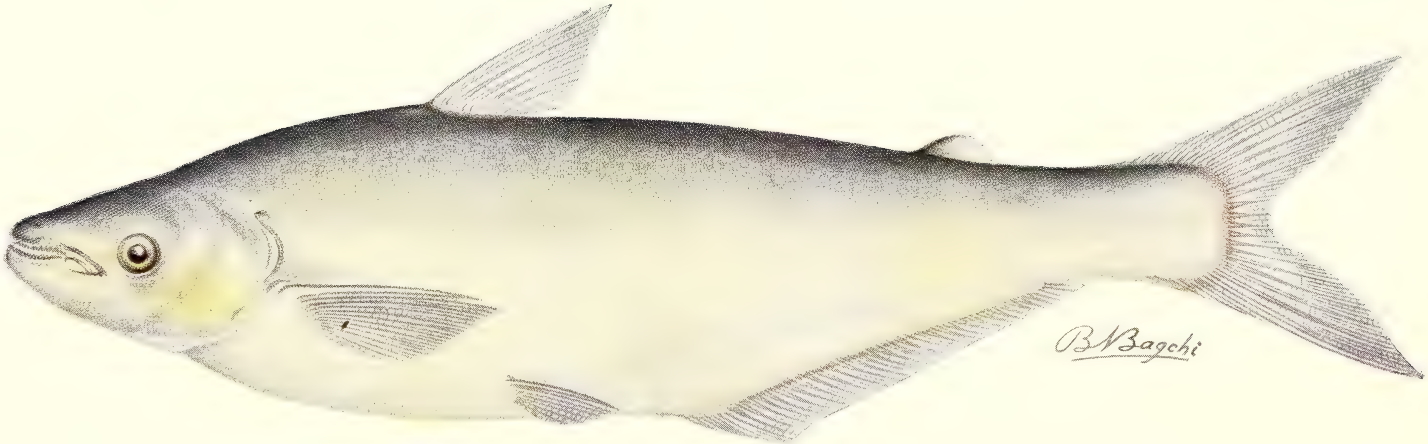

THE SILOND CATFISH
Silonia silondia (Hamilton).

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THE GAME FISHES OF INDIA.[1]

BY

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(*With one plate and four text-figures*).

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IV.—The Silond Catfish.

Silonia silondia (Hamilton).

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Introduction.

Among a great variety of Indian Catfishes, there are four species, *viz.*, *Silonia silondia* (Ham.), *Pangasius pangasius* (Ham.), *Bagarius bagarius* (Ham.) and *Wallagonia attu*[2] (Bloch), which attain a size of about five to seven feet in length, and on account of their voracious habits and powerful build are sometimes called 'Freshwater Sharks'. They cause considerable damage to fisheries

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[1] Published with permission of the Director, Zoological Survey of India.

[2] Myers (*Copeia*, p. 98, June 1938) has restricted the use of the generic denomination *Wallago* to *W. dinema* Bleeker and has included the Indian species in his new genus *Wallagonia*.

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and are very undesirable in several respects. However, they provide considerable sport to anglers, and are regarded game fishes of no mean value. The present article deals with the *Silond* Catfish, which is perhaps the most powerful of all the four species enumerated above and whose flesh is certainly more prized than that of the others. The following three articles will be devoted to the treatment of the three other so-called freshwater sharks.

NOMENCLATURE AND SYSTEMATIC POSITION.

Hamilton (**3**)[1] who discovered the *Silond* Catfish for science, named it *Pimelodus silondia*, but later workers regarded Hamilton's *Pimelodus* as a generalised, composite genus and split up his group of 33 species into several genera. Swainson (**6**) removed the first two species of Hamilton's *Pimelodus*—*P. silondia* and *P. chandramara*, to a new subgenus *Silonia* of *Ageniosus* (*sic*) which was defined as follows:—

> 'Body of equal thickness with the head, which is not dilated; eyes very large; cirri two, very minute; adipose dorsal very small, oval; gill-membrane ten-rayed; ventral fin beneath the first dorsal; caudal fin slightly lunate.'

The two species included by Swainson under *Silonia*, *S. lurida* Sw. (=*P. silondia* Ham.) and *S. diaphina* Sw. (=*P. chandramara* Ham.), are quite different from each other, except that both were characterised by Hamilton as possessing only two barbels. *P. silondia* is, however, designated as the type of the species and it is to the fishes of this kind that the generic designation of *Silonia* is now applied.

Probably being unaware of Swainson's classification, Cuvier and Valenciennes (**1**) also proposed a new genus *Silundia* for the same two species of Hamilton's *Pimelodus* and characterised it as follows:—

> 'Les Silondies sont des siluroïdes, voisines des Bagres, à petite tête lisse, fort semblable à celle des schilbes, à très-petite nageoire dorsale adipeuse, à longue nageoire anale, qui n'ont que deux barbillons maxillaires, et tellement petits, qu'il faut de l'attention pour des découvrir. Leurs rayons branchiostèges sont au nombre de douze. Leurs dents de mâchoires, sur un on deux rangs seulement, sont plus longues et moins semées que dans les autres siluroïdes. Nous n'en connaissons bien qu'une espèce le *pimelodus silundia* de Buchanan; mais il me paraît que le *pimelodus chandramara* du même auteur s'en rapproche au moins beaucoup.'

Cuvier and Valenciennes changed the specific name of *Silond* to *Silundia gangetica* and the later workers adopted this name without any reference to Swainson's earlier work. As *Silonia* Swainson has priority over *Silundia* Cuvier and Valenciennes, in accordance with the International Rules of Zoological Nomenclature the species must now be designated as *Silonia silondia* (Hamilton).

As recognised here *Silonia* is a monotypic genus. Some authors have regarded Sykes' (**7**) *Ageneiosus childreni* as a doubtful member of this genus but I (**4**) have placed it in a separate genus *Silonopangasius* Hora. Day (**2**) described a new species of

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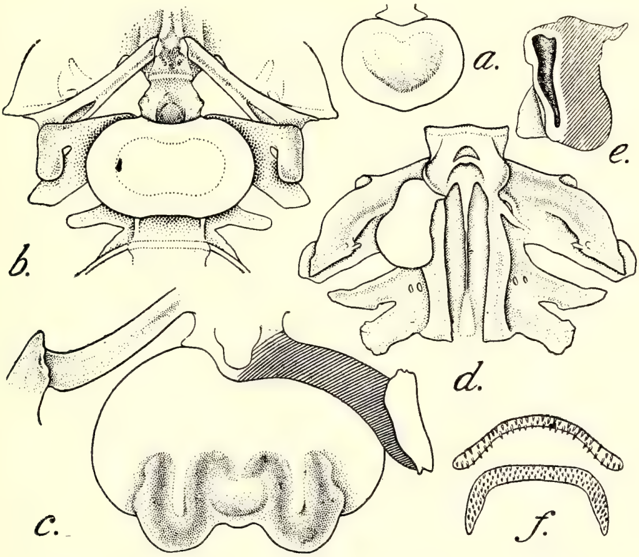
[1] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

Silundia, S. sykesii, from Deccan and was doubtfully of the opinion that it may be synonymous with Sykes' *childreni.* In the collection of the Zoological Survey of India there is a considerable material of the Deccan form. Though both the species possess caniniform teeth which project outside the mouth-opening, *Silonopangasius childreni* has two pairs of barbels while *Silonia silondia* has only one pair. The structure of the air-bladder is also different in the two species. Moreover, the Deccan form rarely exceeds a foot and a half in length.

Taylor, Day, and Bridge and Haddon described the air-bladder of *S. silondia,*[1] but their accounts differ greatly from one another. On dissecting a number of specimens of various sizes it was observed that the form of the air-bladder undergoes considerable changes during growth. I reproduce here (text-fig. 1) four drawings of the air-bladders of specimens 53 mm., 131 mm., 237 mm. and



Text-fig. 1.—Air-Bladder, associated skeletal structures, and dentition of *Silonia silondia* (Ham.).

a. Air-bladder of a specimen 53 mm. in length without caudal. $\times 3$; *b.* Air-bladder of a specimen 131 mm. in length without caudal. $\times 3$; *c.* Air-bladder of a specimen 237 mm. in length without caudal. $\times 2\frac{1}{2}$. The portion shaded by section lines represents a strong fibrous structure by which the bladder is attached to the neighbouring skeletal elements; *d.* Air-bladder of a specimen about 1.070 mm. in length without caudal. $\times \frac{1}{2}$. The bladder from the right side is removed to show the nature of the bones to which it is firmly attached; *e.* Longitudinal horizontal section of the air-bladder shown in *d.* $\times \frac{3}{4}$. The portion shaded by section lines represents the solid, fibrous part of the bladder, while its cavity is shaded black with dots; *f.* Upper dentition of a specimen 237 mm. in length without caudal. Nat. size.

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[1] For references to the accounts of Taylor, Day, and Bridge and Haddon see the synonymy of the species on page 141.

1,070 mm. in length without the caudal, respectively. In both the earlier stages the form corresponds with that described by Bridge and Haddon, while that of the third specimen approaches the type described by Day. Fortunately, Taylor noted that his specimen was about 8 pounds in weight, so he was certainly dealing with a much larger specimen than those examined either by Day or by Bridge and Haddon. Taylor's description more or less corresponds with the form of the bladder of the largest specimen examined by me. Nair (**5**) has recently given an account of the changes in the internal structure of the air-bladder of *Silonia silondia* during growth.

The genus *Silonia* may now be defined as follows:—

The body is elongated and compressed. The head and body are covered with soft skin. The head is of moderate size and is rounded anteriorly. The median fontanel extends throughout the length of the head. The occipital process is sharply pointed posteriorly and there is a considerable space between it and the basal bone of the dorsal fin. The eyes are situated laterally behind the angle of the mouth and are visible both from above and below; they are provided with circular adipose lids. The mouth is anterior, wide and obliquely directed upwards. The lower jaw is somewhat longer than the upper and broadly pointed in the middle. The teeth in the jaws are large and caniniform; they project outside the mouth-opening. There is a continuous U-shaped band of villiform teeth across the palate. The lips are well developed near the angles of the mouth and are continuous. The post-labial groove is widely interrupted in the middle. The nostrils are situated wide apart and are slit-like; the anterior nostrils are along the front edge of the snout while the posterior ones are placed backwards and inwards. There are only two small maxillary barbels which lie in grooves and are liable to be overlooked. The dorsal fin is situated considerably in advance of the ventrals; it is provided with a moderately developed bony spine which is roughened externally and serrated internally. A small adipose dorsal is present in the last fourth of the body length. The anal fin is very long. The pectoral fin is provided with a strong, bony spine which is roughened externally and serrated internally. The pelvic fins possess 6 rays each. The caudal fin is deeply forked. The gill-openings are wide. The gill-membranes are deeply notched; they are united with each other but are free from the isthmus. There are 11-12 branchiostegal rays. The air-bladder is greatly reduced, thick-walled and uniform in the earlier stages; it has its long axis transversely disposed and lies across the body of the anterior, modified vertebrae. It is not enclosed in bone but is supported laterally by the transverse processes of the fourth vertebrae.

Genotype:—*Silonia lurida* Swainson 1838=*Pimelodus silondia* Hamilton 1822.

Distribution:—Same as of the only species, *vide infra*, p. 143.

Relationships:—*Silonia* belongs to the family Schilbeidae of the order *Siluroidea*. This family is represented by a number of genera both in the Oriental and the Ethiopian Regions. As I (**4**) have remarked elsewhere *Silonia* with one pair of barbels is probably a primitive form in the family, though owing to its highly predaceous habits it has developed large caniniform teeth in both the jaws. Its close allies are represented today by forms like *Pangasianodon* Chevy of Siam and Indo-China, and *Silonopangasius* Hora of Southern India. The former, like *Silonia*, grows to a very large size, while the latter rarely exceeds a foot and a half in length.

SYNONYMY AND DESCRIPTION.

Silonia silondia (Hamilton).

1822. *Pimelodus silondia,* Hamilton, *Fish. Ganges,* pp. 160, 375, pl. vii, fig. 50.

1830. *Pimelodus silondia,* Taylor, *Gleanings in Science,* p. 171 (air-bladder).

1838-39. *Silonia lurida,* Swainson, *Nat. Hist. Fish.*, etc., i, p. 345, fig. 85; *ibid.*, ii, p. 305.

1840. *Silundia gangetica,* Cuvier & Valenciennes, *Hist. Nat. Poiss.,* v, p. 49, pl. ccccxxvi.

1853. *Silundia gangetica,* Bleeker, *Verh. Bat. Gen.*, xxv, p. 118.

1858. *Silundia gangetica,* Blyth, *Proc. As. Soc. Bengal,* p. 28.

1863. *Silundia gangetica,* Bleeker, *Ned. Tijdschr. Dierk.*, i, p. 108.

1864. *Silundia gangetica,* Günther, *Cat. Fish. Brit. Mus.,* v, p. 65.

1873. *Silundia gangetica.* Day, *Rep. Freshw. Fish Fisheries India and Burma*, p. 269.

1876. *Silundia gangetica,* Day, *Journ. Linn. Soc. London,* xii, p. 570.

1877. *Silundia gangetica,* Day, *Fish. India*, p. 488, pl. cxiv, fig. 3.

1877. *Silondia gangetica,* Beavan, *Freshw. Fish. India*, p. 136.

1889. *Silundia gangetica,* Day, *Faun. Brit. Ind. Fish.*, i, p. 145, fig. 62.

1894. *Silundia gangetica,* Bridge & Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, pp. 222, 223 (air-bladder).

1937. *Silonia silondia,* Hora, *Curr. Sci.,* v, p. 352 (affinities and distribution).

1938. *Silonia silondia,* Nair, *Rec. Ind. Mus.,* xl, pp. 5-11, 6 figs. (air-bladder).

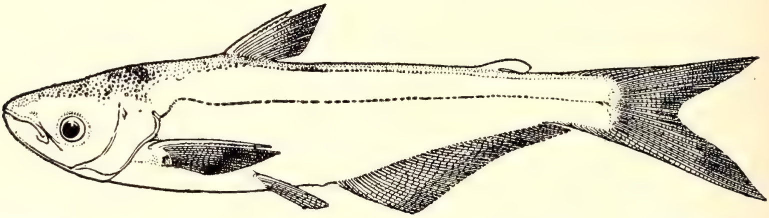
Vernacular Names:—*Silun* (Bengal, for young and half-grown), *Dhāīn* (Bengal, for larger specimens); *Silondia-vacha* (Calcutta); *Silon* (Dinajpore and Rungpur); *Baikar* (Gorakhpur); *Silond* (Punjab); *Ji-lung* and *Silond* (Ooriah and Bengali).

In the higher Bengali dialect this species is known as *Silandha* while its Sanskrit names are *Silendhra* and *Silindha* (*vide* Hamilton's list of Bhagalpur fishes).

B. 11-12; D. 1/7; A. 40-46; P. 11-13; V. 6; C. 17.

Silonia silondia is herring-shaped in its younger stages, but in the adult condition its belly becomes very bulky. The dorsal and ventral profiles are almost equally arched in the young individuals (text-fig. 2 and plate), but in full-grown specimens the ventral profile is greatly arched (text-fig. 3). The length of the head is contained from 5·0 to 5·8 times in the total length and from 4·0 to 4·6 times in the length with the caudal. The head is proportionately shorter in the larger individuals. The width of the head is about two-thirds of its length. The depth of the body undergoes considerable variations with age; it is contained from 4·7 to 7·4 times in the total length and from 4·0 to 6·0 times in the length without the caudal. The eyes are lateral in position and are visible both from above and below; the diameter of the eye is contained from 3·1 to 4·4 times in the length of the head, from

1·2 to 2·0 times in the interorbital width and from 1·0 to 1·5 times in the length of the snout. Proportionately the eyes are much smaller in larger individuals. The eyes are provided with narrow adipose lids. The head is provided with a median fontanel along its entire length which is shallow in front and somewhat deeper behind. The occipital process tapers to a fine point posteriorly; it is thrice as long as broad and is separated from the basal bone of the dorsal fin by a considerable distance. The mouth is slightly ascending. The lower jaw is broadly pointed in the middle and is somewhat longer than the upper. There is a pair of small maxillary barbels which lie in grooves and do not extend beyond the eyes. The teeth in the jaws are caniniform and arranged in two series in each jaw; those of the outer series invariably project beyond the mouth-opening. The teeth on the palate are villiform and are arranged in a U-shaped band.



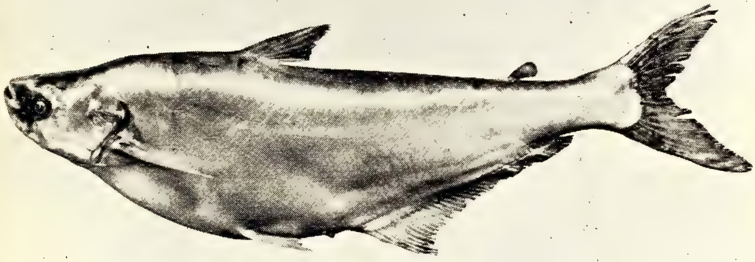
Text-fig. 2.—Lateral view of a young specimen of *Silonia silondia* (Ham.) 72 mm. in total length, collected from the river Hooghly in November 1937.

The dorsal fin is considerably, but not wholly, in advance of the ventrals; its forward position is more marked in the young than in the full-grown specimens. The dorsal spine is rather slender; it is rugose anteriorly and finely serrated posteriorly in its upper portion; it is about two-thirds the length of the head. The pectoral fin extends beyond the origin of the ventrals in young and half-grown specimens, but in larger specimens it does not reach to the base of the ventrals. The pectoral spine is similar to that of the dorsal fin. The adipose fin is small, but well-marked; it is situated above the posterior portion of the anal fin. In younger specimens it is in the posterior quarter of the length of the body, whereas in a fully mature specimen it lies in the posterior fifth of the body length. The ventrals just reach the anal opening and are separated from the anal fin by a short distance. The caudal fin is deeply forked; both the lobes are of equal length. The least height of the caudal peduncle is contained from 1·4 to 1·7 times in its length.

Colouration:—According to Hamilton (3) 'The back is of a dusky green *colour*; and, although the sides are like silver, the fish has a dirty lurid appearance, with a shade of livid hue. The back and tail fins are greenish, the others are white.' Some time after the fish is removed from water the back assumes a neutral tint while the ventral surface and sides become silvery. The opercle is shot with orange and yellow which is continued forwards to the mouth-opening. The iris is of an orange colour. The dorsal fin is of a light neutral tint; the pectoral fin is also of the same colour but is provided with an orange band at the base. The ventrals are slightly tinted with orange. The anal fin is light purple with an orange band at the base. The adipose fin is of a purple colour. The tail fin is much darker and at the base is provided with a band of light Indian red colour.

In young specimens, below 4 inches in length, the dorsal and the pectoral fins after preservation in spirit are deeply stained with black. The posterior margin of the caudal fin and a considerable part of its superior lobe are also stained with black. These colour marks gradually fade away during growth.

Distribution:—Day in his *Fishes of India* states that this species is found in the 'Estuaries of India and Burma, ascending high up the larger rivers to nearly their sources'. The collection in the Indian Museum contains no specimen of *S. silondia* from Burma. Prof. F. G. Meggitt, at my request, sent to the Museum a collection of the local Rangoon fishes, but this species is not represented in that collection. It may also be noted that Vinciguerra (8) in his account of the fishes of Burma does not record this species. It seems doubtful, therefore, whether the species is actually found in Burmese waters.[1] If, however, it occurs in Burma, it will be worthwhile to make a detailed study of the Burmese specimens and to compare them with the Indian examples



Text-fig. 3.—Photograph of a large specimen of *Silonia silondia* (Ham.), 50 inches in total length, purchased from the Calcutta market.

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[1] Macdonald (*Journ., Bombay Nat. Hist. Soc.*, xxxiii, p. 306, 1929) records the occurrence of *Silund* (*Silundia gangetica*) in the higher reaches of the Irrawadi river.

to see the effect of isolation on them, as was found to be the case in *Eutropiichthys vacha* (Ham.) and *Clupisoma garua* (Ham.) (*vide* the second and the third articles of this series).

In South India *Silonia silondia* is replaced by the allied form *Silonopangasius*, and from the information available it seems probable that *Silonia* is restricted only to the Indo-Gangetic basin of Northern India.

As the body proportions vary considerably with growth, I give below in inches the measurements of a specimen over 4 feet in length (text-fig. 3). The measurements are only approximate.

Measurements in inches.

Total length without caudal	42·5
Length of caudal	7·5
Length of head	8·0
Length of snout	2·5
Diameter of eye	1·7
Depth of body	12·5
Length of pectoral	6·7
Length of dorsal	6·5
Length of ventral	4·5
Length of anal base	14·0
Length of caudal peduncle	6·0
Least height of caudal peduncle	3·7
Distance between tip of snout and origin of first dorsal	15·5
Distance between tip of snout and origin of ventrals	15·5
Distance between ventrals and anal fin	8·0
Distance between rayed dorsal and adipose dorsal	17·0

BIONOMICS AND FISHING NOTES.

Hamilton (3) noted that *Silonia silondia* 'is very common in the Gangetic estuaries, and is considered by the natives as good eating. It commonly grows to three feet in length, and occasionally to twice that size.' This species is a common food fish of Bengal and in the Calcutta markets large quantities of this fish are sold. The majority of the specimens, as stated by Hamilton, are below three feet in length.

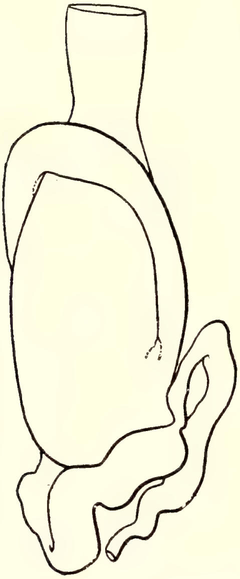
It is a voracious feeder and does considerable harm to the fisheries. The young specimens, below 4 inches in length, collected from the river Hooghly were found feeding on prawns, young fish, etc. while the largest specimen examined had full-grown *Hilsa ilisha* (Ham.) in its stomach. The stomach is a large bag-like structure about twice as long as broad (text-fig. 4); the alimentary canal is only slightly convoluted. In a young specimen about 93 mm. in length, the length of the alimentary canal was about 80 mm. In a specimen 50 inches long, the stomach measured 11 inches in length and 5·5 inches in breadth. The length of the intestine was 62 inches.

Silonia silondia probably breeds in the rainy season as young specimens from three to eight inches in total length were found to be fairly common in November-December in the catches from the river Hooghly at Nawabgunge about 20 miles above Calcutta.

Measurements in millimetres.

Total length excluding caudal	54·0	100·0	108·0	135·0	144·0	155·0	200·0	203·0	330·0
Length of caudal	Damaged	26·0	28·0	32·0	31·0	45·0	48·0	41·0	Damaged
Length of head	13·0	25·0	25·0	30·0	31·0	34·0	45·0	45·0	70·0
Width of head	8·5	15·0	16·0	20·0	21·0	25·0	30·0	31·0	48·0
Width of body	6·0	10·0	12·0	16·0	16·0	20·0	25·0	26·0	42·0
Depth of body	9·6	17·0	20·0	26·0	31·0	39·0	45·0	51·0	76·0
Diameter of eye	4·0	8·0	8·0	9·0	9·0	10·0	11·0	11·0	16·0
Interorbital width	6·0	9·4	11·5	13·0	12·0	15·5	18·0	19·0	32·0
Length of snout	5·0	8·4	9·0	11·0	14·5	13·0	15·0	14·5	24·5
Length of dorsal spine	8·0	14·0	16·0	21·0	16·0	Damaged	31·0	30·0	55·5
Length of pectoral spine	10·0	18·0	20·0	23·0	23·0	27·0	35·0	35·0	56·0
Length of maxillary barbel	3·0	4·0	3·0	3·5	4·0	3·0	5·0	4·0	3·5
Length of caudal peduncle	7·0	11·0	13·0	17·0	19·0	20·0	24·0	27·0	32·0
Least height of caudal peduncle	4·5	6·5	8·0	10·0	11·5	14·5	17·0	17·5	25·0

In the list of Gorakhpur fishes Hamilton noted under *Baikar* that 'in this district it is said never to exceed six inches in length'. Presumably Hamilton was in Gorakhpur after the rainy season when the young fish are common in the river. It also seems probable that *Silonia* ascends rivers for breeding purposes and when the waters fall after the rains it becomes stranded in large pools in the upper reaches of the river. Principally it is an estuarine fish.



Text-fig. 4.—Alimentary canal of *Silonia silondia* (Ham.).

The *Silond* Catfish is a very game fish and fights well. It frequents the same type of habitats as the *Goonch*, but prefers stronger streams and clear white deep waters. The usual bait is a spoon or a fish, but specimens have also been caught on a Mahseer fly and provided good sport with this tackle also.

Though *Silonia silondia* is primarily a fluviatile fish, it can flourish in tanks and large reservoirs as well. In the Settling Tanks of the Calcutta Corporation Waterworks at Pulta the species is very common and attains a large size. It enters these reservoirs in the egg or larval stages. From a practical fisheries point of view its cultivation should be discouraged, as it is very destructive to other types of edible fishes.

ACKNOWLEDGMENTS.

The Bombay Natural History Society very kindly made a grant towards the cost of the illustrations and for this I offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra, M.SC., my assistant in the Zoological Survey of India, has helped me in the preparation of the tables of measurements and for this I am indebted to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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EXPLANATION OF PLATE.

Colour sketch of the lateral view of a specimen, 214 mm. in length without caudal, of *Silonia silondia* (Hamilton) from the river Hooghly.

Immediately after the fish is taken out of water its colour is golden, but it fades quickly. The fish then becomes blue-backed with a white belly.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SÁLIM ALI AND HUMAYUN ABDULALI

PART IV.

(*With 2 plates*).

(*Continued from p.* 688 *of Vol.* xxxix).

The Common Weaver-Bird or **Baya** : *Ploceus philippinus philippinus* (Linn.).

Local name : *Sōn-chiri.*

Field identification : Size of the House-Sparrow. In non-breeding plumage both sexes very like the female of that bird, but with a thicker bill and somewhat shorter tail. In the breeding season the male acquires a golden-yellow head and breast, and the back is suffused with the same colour. The throat and sides of the head are dark brown. Flocks about rice cultivation.

Specimens : *B.N.H.S.* : o? 21-3-24 Chembūr (S.A.) ; ♀ 14-1-13 Santa Cruz (N. B. Kinnear) ; *St. Xavier's College* : 63 ♀, 64 ♂, 65 ♂ 3-9-33 Jogēshwari ; 186 ♂ 19-3-34 Gōrēgāon ; 205 ♀, 206 o? November '34 (H.A.).

Apparently a local migrant to some extent, as it becomes quite scarce in Salsette during January and February. Common on the open outskirts of the city, in the suburbs and throughout the island of Salsette. In the dry season flocks may usually be met with gleaning paddy in stubble fields. At this period, however, they split up into smaller or larger parties and spread far and wide over the countryside. They are also less noisy, and therefore not so conspicuous as when nesting. They do a certain amount of damage to ripening paddy crops. *Erythrina* flowers are largely resorted to in season both for the nectar and for the newly forming pods. Lantana berries are also eaten. At night, large numbers foregather to roost among tall grass patches and the mangroves by our tidal creeks, such as at Mahūl and Gōdhbunder. Here, hundreds of birds may be observed any evening arriving from all quarters. They also roost amongst the reeds and bulrushes round the margin of Powāi Lake.

Breeding : Many males have already acquired breeding plumage by the middle of May, but the nesting is not in full swing until the monsoon is well set. During the rains nest colonies are to be seen dotted about on bēr and babool trees and palmyra and date palms all over Salsette. By the middle of October all the chicks have left the nests.

The retort-shaped, woven, fibre nests are too well known to need description. The building work is done almost entirely by the males. In the earlier stages of a building colony the females are absent. They arrive only after some of the nests are half built, and take possession of these if approved. Thereafter the hen helps the cock in finishing off the interior. When the nest is ready, the eggs laid and the hen brooding, the cock commences to build another nest on a nearby twig which, in due course, may be appropriated by a second roving or prospecting female. In this way some cocks have three or more nests with as many wives, acquired one at a time. The usual number of eggs in a nest in Salsette is 2 to 4. They are pure white in colour.

[**The Black-throated Weaver-Bird** : *Ploceus benghalensis* (Linn.).

We have not come across this species in our area, but Wenden (*N.* & *E.*, ii, 120) records finding 8 or 10 nests, some containing eggs, at Bhāndūp on 28 August somewhere about 1880 (?).]

[**The Striated Weaver-Bird** : *Ploceus manyar* ssp.

Not met with by us, but there is a specimen listed in the Bombay Natural History Society's Card Catalogue as from Bombay. It is doubtful however, if this was a wild bird or one procured in the local bird market.]

The White-backed Munia : *Uroloncha striata striata* (Linn.).

Field identification : Smaller than the House-Sparrow. A small black-and-white finch with a heavy conical bill and wedge-shaped tail. Sexes alike. Pairs or small flocks in scrub country, about roadside hedges, etc.—often feeding on the ground.

No specimen. Noted : *Salsette* : Chembūr, Andhēri, Borivli.

Resident. Not common in Salsette though pairs and small flocks are occasionally seen. We have observed them feeding on grass seeds both on the ground and from off the stems. They are also very partial to bamboo seeds whenever available.

Breeding : In Salsette and across the Harbour—at Kihim and Alibāg, where it is common—we have found nests in various stages of construction or with eggs and young chiefly between March and November. August and September, however, appear to be the months when most eggs are laid. The nest is an untidy globular structure with entrance-hole on one side, occasionally in the form of a short tube. It is made of fine soft feathery grass, intermixed on occasion with a little coarse grass and even cocoanut fibre. It is placed between 5 and 10 feet up in a small bēr, lime or similar tree or bush, in scrub country and gardens. We have frequently observed four birds working on a single nest, but whether more than one female uses it for laying in at a time is not known. The nests are certainly used as dormitories by the entire family long after the young have flown. The eggs, pure white in colour with a pinkish tinge when fresh, number four to seven. Both parents roost within the nest at night even before the first egg is laid, and continue to do so throughout the incubation period. Brooding seems to commence in earnest only after the laying of the last egg. In one clutch of 5 eggs the incubation period was ascertained to be 13-14 days from the last egg (or 19 from the first). Both parents feed the young, apparently largely by regurgitation. The nests become foul with the excreta of the young, which are not removed.

The White-throated Munia : *Uroloncha malabarica* (Linn.).

Field identification : Size same as the last. A plain earthy-brown, thick-billed little bird with a pointed black tail, whitish underparts and a white rump. Flocks feeding by hedges and along cart tracks in open scrub country, gardens etc.

Specimens : *B.N.H.S.* : o? 5-7-25 Borivli (S.A.) ; *St. X. C.* : 87 ♂, 88 ♀ 25-9-33 Jūhū (H.A.).

Resident. Not uncommon in our area but perhaps more plentiful across the harbour in the Kolāba District. It prefers open sparsely scrubbed country and babool jungle. H.A. has noted it as common on the Reclamation at Church Gate (1933-35) and Br. Navarro observed it making abortive attempts at nest-building there in September.

Breeding : We have records of nests from Borivli, Chembūr and elsewhere in Salsette, and from Kihim (across the Harbour, in Alibāg Talūka) for every month in the year except December, January and February. This Munia habitually utilises disused Baya nests for laying purposes. Indeed it may almost invariably be seen haunting Baya nest-colonies even while the legitimate owners are still in occupation, entering the hanging tubes as opportunity offers. Although so far we have never found its eggs in occupied Baya nests but only in old and deserted ones, it is quite conceivable from its behaviour that it may in course of time develop a habit of parasitism on the Baya. When constructed by the bird itself, the nest is an untidy globular affair with a lateral entrance hole, similar to the Striated Munia's but with fine twigs on the exterior and often lined with feathers. Large feathers such as those of egrets and rollers are often used. The nest is placed in a babool, bēr or other thorny bush usually at heights of 6-12 feet. We have found, as a rule, 4-7 white unmarked eggs in a clutch. Both when self-built and when appropriated from a Baya, the nests are used as dormitories when the breeding season is over, as many as 6 or 8 birds—probably parents and their brood—crowding into a single nest to roost.

The Spotted Munia : *Uroloncha punctulata lineoventer* (Hodgson).

Field identification : Shape and size about the same as the last. In breeding plumage head and upper parts chocolate-brown. Underneath white with black speckles. In non-breeding plumage more or less plain brown. Pairs, parties or flocks, according to season, feeding on ground in open scrub-and-grass country, and by cultivation.

Specimens: *B.N.H.S.*: oo 7-2-24, o 8-3-24 Pāli Hill, Bandra (S.A.); ♂ 1-12-12 Santa Cruz, ♀ 4-12-09 Andhēri (N. B. Kinnear); *St. X. C.*: 62 ♂ 3-11-33 Jogēshwari; 73 o, 74 o, 75 ♂ juv., 76 ♂ 12-11-33 Andhēri (H.A.).

Resident. Common. Often met with in large flocks of 75-100 birds or more. In the cold weather these flocks comprise largely of individuals in the plain brown plumage. A conspicuous change is noticeable by the first week of March when a large number are in the chestnut and spotted phase. This increases gradually until by July or August, when the breeding season is at its height, the majority of birds (if not all) are in the speckled plumage. The flocks have of course then mostly broken up into pairs. When a flock is disturbed feeding on the ground, the birds fly up into trees and bushes uttering feeble chirrups.

Breeding: The season in our area is a prolonged one lasting from about June to December. The nest is the usual globular structure of a Munia, made of grass blades, and is placed in the same sort of situations as that of the two previous species. We have, however, seen several nests in Salsette built at the bases of palmyra leaves, 40 ft. or more up. A normal clutch consists of 4-6 white eggs.

The Indian Red Munia: *Amandava amandava* (Linn.).

Field identification: Slightly smaller than the foregoing, with a square (not pointed) tail. In breeding plumage the male is a beautiful deep crimson with white spots on the breast and flanks. Female brownish with a red bill and crimson rump. The male in non-breeding dress resembles the female. Flocks about tall grassland and amongst reeds.

Specimens not collected.

Status? This Munia is rare in Salsette. We have come across it only on three occasions and it is possible that these were all escaped cage birds. The Red Munia or 'Waxbill' is a favourite with fanciers and large numbers from upcountry are always for sale in the Crawford Market.

Breeding: Aitken (*C.B.B.*, p. 138) saw a pair making a nest at Tārdeo. According to Betham (*J.B.N.H.S.*, xii, 78) it breeds in the neighbourhood of Poona at the beginning of September.

The Common Indian, or **Hodgson's Rose-Finch**: *Carpodacus erythrinus roseatus* (Blyth).

Field identification: Size about that of the House-Sparrow, with thicker bill and slightly forked tail, the last being a conspicuous feature. The male in full plumage has a beautiful crimson-pink head, breast, back and shoulders; the female is brown with an olive tinge. Flocks in flowering trees, Lantana bushes and sometimes on the ground.

Specimens: *B.N.H.S.*: ♀ 8-12-25 Gōdhbunder, ♂ 3-3-29 Tūlsi Lake (S.A.); ♂ 1-12-23 Andhēri (S. H. Prater); *St. X. C.*: 187 ♂ 21-3-34 Borivli (H.A.).

Winter visitor and passage migrant. Fairly common. Flocks usually arrive in Salsette about mid-November and some individuals stay over till the first week of April. The birds are much more in evidence about March when their numbers are augmented by the return passage from the south. While with us, we have observed Rose-Finches feeding largely on Lantana berries and on nectar from the flowers of *Calycopteris floribunda, Erythrina indica* and various other species. Large quantities of *Erythrina* pollen were found on the forehead and chin of specimens shot off the flowers, and the birds doubtless do service in cross-pollination. The call note is a pleasant interrogative whistling *tooee?*

The Yellow-throated Sparrow: *Gymnorhis xanthocollis xanthocollis* (Burton).

Field indentification: Size that of the House-Sparrow. Earthy-brown above, whitish below. The male has a lemon-yellow patch on the throat, two whitish bars on the closed wing and a bright chestnut patch near the shoulder. The female lacks the yellow throat-patch, and the chestnut on her shoulders is duller. Slightly but markedly forked tail. Pairs and flocks, according to season, by village cultivation, and in open deciduous forest.

Specimens: *B.N.H.S.*: ♂ 21-3-24 Chembūr; o? 6-4-24 Sion Causeway (S.A.).

Noted: Elephanta Island, Thāna, Borivli etc. Common on the mainland—across the harbour—at Kihim, Alibāg etc.

The Yellow-throated Sparrow is a common breeding species in our area. It is a local migrant; during the monsoon months practically none are to be seen, but its numbers increase again after about the first week of October. Parties of from 8 to 20 birds may be seen gleaning in harvested paddy-fields and in the vicinity of threshing floors in villages. Along with numerous other bird species, they invariably feed on the nectar from *Bombax* and *Erythrina* flowers in season. During the heat of the day flocks collect in leafy trees and spend the hours in noisy chirping. The call-notes are very like those of the House-Sparrow, somewhat pleasanter.

Breeding: The nesting season lasts from March to May. The nest is a pad of hair and fibres lined with feathers, and placed inside natural hollows in trees, barbet- and woodpecker-holes, pipes, old disused street lamps, etc. Two to four eggs—in appearance very like those of the House-Sparrow—is what we have found to comprise a normal clutch. Both parents share in feeding the young.

The Common House-Sparrow: *Passer domesticus indicus* Jardine & Selby.

Local name: *Chiri.*

Field identification: Too well-known to everybody to need description. A commensal of man.

Specimens: *B.N.H.S.*: ♂ 12-6-07 Worli, Bombay (Mr. Strong); *St. X. C.*: 192 ♂, 193 ♀ 4-4-34 Bombay City (H.A.).

Resident. Abundant alike in city and suburbs, as well as in villages farther afield, and by human habitations of every description. Often feeding in large flocks on the maidans and the Reclamation area. There is a recent record of a sparrow being struck in mid-air and killed by a cricket ball while a match was in progress on the grounds of the Islam Gymkhana! Large numbers collect every evening at sunset to roost in favourite trees and much noise and bickering prevails before the birds finally retire, usually well past dusk. It is difficult to conjecture what determines the choice of a particular roost out of several apparently equally suitable trees. How long the same tree continues to serve as a roost we do not know, but we know one that had been in occupation for three years at least. The Green Whip Snake (*Dryophis mycterizans*) commonly preys upon House-Sparrows in the suburbs, and crows and cats do great destruction amongst their fledglings everywhere. Albinism appears to be a not uncommon disease among the sparrows in Bombay. Several cases of complete or partial albinism have been reported from time to time.

Breeding: Sparrows breed practically throughout the year and make themselves a thorough nuisance in more ways than one to the inmates of the dwellings they select. Holes in the masonry of buildings and wells are most commonly used. Every conceivable site, such as the angle behind a picture hung on a wall and the globes of lamps, is appropriated. The inverted glass bell-jars, so commonly seen in mosques and fire-temples, offer irresistible opportunities for nesting. Gargoyles and drain pipes are everywhere much patronised. We have observed a bird trying to build up in a papaya tree and another on an *Erythrina*. The nest is an untidy collection of grass and feathers, and during its construction a formidable accumulation of rubbish litters the ground below. The usual clutch here consists of 3-5 eggs, greenish-white in ground colour, blotched and speckled with greyish-brown.

The Black-headed Bunting: *Emberiza melanocephala* Scopoli.

Field identification: Slightly larger than the House-Sparrow with a longer and noticeably forked tail. Head black. Bright yellow underparts and much of this colour in the rest of the plumage also. In the female the head appears rufous-brown and the yellow in her plumage is merely a suffusion of greyish-olive. Flocks, in and about cultivation.

Specimens: *B.N.H.S.*: ♀ 30-12-07 Andhēri; ♂ 9-11-12 Santa Cruz (Kinnear).

Winter visitor. This Bunting is very common in the cold weather in Deccan and small numbers may also be met with in our area. Aitken (*C.B.B.*, p. 144) mentions it as a winter visitor to Bombay. We have not come across it actually within Salsette, but in the Kolāba District across the harbour, flocks are not uncommon from the beginning of November up to

March. The birds usually feed on hedged-in cross-country cart tracks, and in fields in the vicinity of villages.

There are no records of the Red-headed Bunting (*Emberiza icterica*) in Salsette, but it is not unlikely to occur here, as in the Deccan, in mixed flocks with the Black-headed Bunting.

[**The Crested Bunting** : *Melophus lathami subcristatus* (Sykes).

There is a specimen of this Bunting in the B.N.H.S. collection from Kalyan. We have come across it at Vāsind. There is no record in Salsette.]

[**The Crag Martin** : *Riparia rupestris* (Scop.).

H.A. has observed this Crag Martin at Karnāla and Panvēl (Kolāba District) on the adjacent mainland in the cold weather (16-2-36), and it is therefore quite probable that it occurs in Salsette also at that season. EHA (*C.B.B.*, p. 41) thought he saw it about Malabar Hill—quite a likely spot in Bombay City. As compared with the next species, which is our common crag martin in this area, it is whitish on the underparts which contrast with the blackish undertail coverts in overhead flight. It is also slightly paler above and larger than the Dusky Crag Martin.]

The Dusky Crag Martin : *Riparia concolor* (Sykes).

Field identification : Somewhat smaller than the House-Sparrow. A uniformly sooty-brown bird with short square tail and swallow-like wings and flight. Usually seen about caves and rock-scarps, and in company with swallows, hawking winged insects.

Specimens : *B.N.H.S.* : o? 2-3-24 Elephanta Island (S.A.); *St. X. C.* : 231 o Bombay (H.A.).

Resident. Not uncommon in Bombay City, the suburbs, and in Salsette generally. In the city it keeps to large and old buildings such as the High Court and the University; farther afield caves—as at Kanhēri, Jogēshwari and Elephanta—and rocky cliffs, ruined forts and buildings are favourite resorts.

Breeding : The nesting season is apparently much prolonged. We have noted nests in various stages of construction or with eggs or young in February, March, April, July, August, October and November. The birds are probably double brooded. H.A. has found them breeding in the city in July, but observes that if the nest is destroyed the birds persist in rebuilding or laying again till they succeed, sometimes as late as October.

The nest is a deepish half saucer of mud pellets collected while damp, at a rain puddle or the like. It is stuck to the perpendicular cliff or wall about 2 inches below the ceiling or rock projection. It is lined with tow or feathers as a rule. The normal clutch consists of 3 eggs. These are white in ground colour, spotted and blotched with purplish-brown. Both sexes share in building the nest, incubating the eggs and feeding the young.

An experiment in the ringing of nesting Crag Martins was tried by H.A. A pair had nested successfully in a ground-floor verandah of St. Xavier's College in the 1932 season. In the following year a pair (then presumed to be the same) built in the verandah of the first floor. They succeeded in raising two young from the second laying, the first clutch having been removed. The parents and young were ringed at the nest at night. In the 1934 season a pair took possession of the identical site, one of which was a ringed bird—obviously one of the four. At the end of the breeding season—during the college vacation—the ringed bird was accidentally destroyed and unfortunately the ring was not read. In the year following a ringless pair took possession of the site. There were no other nests here besides this one in any season. All this shows that where the same site is used year after year, it is not necessarily by the same birds.

The Eastern Swallow : *Hirundo rustica gutturalis* Scop.

Field identification : Smaller than the House-Sparrow. Head and throat chestnut. Upper plumage glossy blue-black with a band of the same colour across breast. Underparts pale. Tail deeply forked—the conventional 'swallow tail'. Gregariously, on telegraph wires, etc. Hawking insects on the wing, especially by water.

Specimens: *B.N.H.S.*: o? 8-4-24 Mud Flats, Sion Causeway (S.A.); o? 16-12-12 Tūlsi Lake (Kinnear); *St. X. C.*: 159 ♀ 9-10-33 Powāi; 184 ♂ 19-3-34 Jūhū (H.A.).

Winter visitor. Fairly common. Arriving in October in flocks, often quite large, which take up positions over long stretches of telegraph wires here and there. By the middle of April practically all birds have departed. All our specimens belong to this race, but the one from Tūlsi Lake appears to be intermediate between this and *rustica*. *Gutturalis* is therefore evidently the race that visits Salsette and not *rustica* as should be the case according to the distribution given in the *Fauna*, vol. iii, pp. 241-2.

The Indian Wire-tailed Swallow: *Hirundo smithii filifera* Stephens.

Field identification: Size as the foregoing. Glossy steel-blue above white below, with chestnut crown. Two long wires in tail which in the female are shorter. May be differentiated on the wing from other swallows by the pure white underparts and the presence of tail-wires. Small flocks, often in association with other swallows, on telegraph wires, etc. or hawking winged insects usually near water.

Specimens: *B.N.H.S.*: ♂ ♀ 12-12-23 Andhēri (S. H. Prater).

Noted: Mud Flats—Sion Causeway, Gōdhbunder.

Resident? Sparsely distributed throughout North Konkan, being everywhere far less abundant than it is in the Deccan.

Breeding: We have no record of nests in Bombay or Salsette, but on 5-5-35 one was observed under the old pier at Dharamtar Ferry (Kolāba District) which contained young. The nest is a half-cup of mud pellets stuck to the wall about 2 inches below the ceiling or an overhang. It is not unlike that of the Dusky Crag Martin. It is built under bridges and culverts, on cliffs near water, and occasionally in buildings. There is usually a lining of grass and feathers.

The Wire-tailed Swallow breeds in some numbers at Khandala (ca. 2,000 ft. —Western Ghāts) in April and May.

[**The Indian Cliff Swallow**: *Hirundo fluvicola* Blyth.

Field identification: Much smaller than the other swallows with a short square tail and black-streaked white underparts. Gregarious; usually large numbers.

Not met with by us, but EHA (*C.B.B.*, p. 41) records seeing it in Bombay. It is common in the neighbourhood of Poona and Betham (*J.B.N.H.S.*, xii, 78) found nests there built under arches of a low bridge, 4 or 5 feet above water level.]

Sykes's Striated Swallow: *Hirundo daurica erythropygia* Sykes.

Field identification: Size about that of the House-Sparrow. Upper parts deep glossy blue except for the chestnut half collar on nape and the chestnut rump. Below pale rufous with fine blackish streaks. Tail deeply forked. Gregariously, about old mosques and buildings and on telegraph wires.

Specimens: *B.N.H.S.*: o? 8-4-24 Mud Flats, Sion Causeway (S.A.); *St. X. C.*: 58 o? juv. 21-8-33 Gōrēgāon (H.A.).

Resident (?) in small numbers. During the cold weather large congregations are seen closely packed on telegraph wires in the early mornings, often covering several hundred yards of the line. Most of these birds are migrants, however, and possibly belong to the race *nepalensis*. Unfortunately we have no specimens collected from such flocks.

Breeding: We have no record from Salsette. For four years in succession we found a nest with eggs on the ceiling of a small rock-cave in the hills near Kihim (Alibāg Talūka) between 15 and 31 May. The nest is retort-shaped, attached to the ceilings of domes, caves, etc. with an entrance passage about 6 inches long. It is made of mud-pellets, and the egg-chamber is lined with grass and feathers. The normal clutch is of 4 eggs, pure white in colour.

The Indian White Wagtail: *Motacilla alba dukhunensis* Sykes.

Field identification: Size about that of the House-Sparrow, slimmer, with a slenderer bill and a much longer tail which is constantly wagged up and down, and longer legs. General colour grey above, white below with a black nape and bib. Ear coverts *white* at all seasons. Singly or small scattered parties, running about on lawns, maidans and open spaces, picking up insects.

Specimens: *B.N.H.S.*: o? 10-2-24, o? 16-2-24 Pāli Hill, Bandra (S.A.); *St. X. C.*: 151 ♂ 27-10-33 Jūhū (H.A.).

Winter visitor. Common. The earliest record we have for Salsette is 2 October; the latest 8 April. During the cold weather months the birds may invariably be seen on all our maidans as well as on the grounds of the Willingdon Sports Club and the Race Course at Mahaluxmi, the various Gymkhanas and the Reclamation along Back Bay.

When the inward migration (autumn) is in full swing, the fresh arrivals may frequently be seen 'swarming' in certain localities of the city and suburbs for a day or two, roosting for the night in large numbers among the roadside trees. The majority of birds pass on subsequently, but the remainder disperse over the countryside to spend the winter in our midst. At the commencement of the hot weather, March-April, there are similar waves of passage migrants from the south.

The Masked Wagtail: *Motacilla alba personata* Gould.

Field identification: Similar to the above, but with the ear-coverts *black* at all seasons.

Specimens: *B.N.H.S.*: ♂ 29-11-23 Andhēri (S. H. Prater).

Winter visitor. Much less common than the White Wagtail and, except for the ear-coverts, difficult to distinguish from it in the field.

[**The Large Pied Wagtail**: *Motacilla maderaspatensis* Gmelin.

Field identification: Larger than the foregoing species—about the size of the Bulbul. Jet black above and on breast, white below, with conspicuous white stripes above the eyes and a broad white patch on the wings. General colour scheme that of the Magpie-Robin. Pairs by rocky streams and near water.

We have not come across this Wagtail in Salsette, neither have we seen any specimens hence. EHA (*C.B.B.*, p. 114) says 'not often seen in Bombay' which would imply that he had seen it occasionally.

We have noted it at Tānsa Lake, and at Rōha, Mahād, Panvēl and elsewhere in the Kolāba District on the mainland opposite.

Breeding: The nearest record we have is from Khandāla (ca 2,000 ft.—Western Ghāts) where Brother Navarro took a c/3 in October 1935.]

The Indian Blue-headed Wagtail: *Motacilla flava beema* (Sykes).

Field identification: Size same as the White Wagtail. Differentiated only in summer plumage from the Grey-headed Wagtail principally by its paler greyish-blue head. Singly or scattered parties, on the wet grassy margins of tanks etc.

Specimen: *St. X. C.*: 78 ♂ 12-9-33 Andhēri (H.A.).

Winter visitor, arriving early.

The Grey-headed Wagtail: *Motacilla flava thunbergi* Billberg.

Field identification: Size as above. In summer plumage distinguishable from the next species by the dark blue-grey head and bright yellow underparts, with no black on throat or breast. Usually several, widely separated, on grassy water-logged ground on the margin of tanks etc.

Specimens: *B.N.H.S.*: ♀ 11-3-24 Pāli Hill, Bandra (S.A.); *St. X. C.*: 115 o? 10-10-33 Jūhū (H.A.).

Winter visitor. Fairly common. Earliest date ?; latest 4 May, '34 (Powāi Lake).

The Grey Wagtail: *Motacilla cinerea caspica* S. G. Gmelin.

Field identification: Size as above. Grey above—with greenish-yellow rump—pale sulphur-yellow below, brighter on abdomen and under the tail. Whitish eyebrows. In summer plumage, just before the birds leave us, chin, throat and upper breast black in male, mottled in female. Almost invariably singly, on damp ground or near streamlets etc.

Specimens: *B.N.H.S.*: o? 5-2-24 Pāli Hill, Bandra; o? 12-10-24 Khār; ♂ 17-3-24 Tūlsi Lake (S.A.); *St. X. C.*: 96 o? 28-9-33 Borivli (H.A.).

Winter visitor. Fairly common. Earliest date 28 September; latest 12 April.

The Black-headed Wagtail : *Motacilla feldegg melanogriseus* Homeyer.

Field identification : Size as above. In summer plumage crown, sides of head and nape black without contrasting eyebrows; white throat, yellow underparts. In winter plumage very confusing in the field and almost impossible to tell with certainty from several other species. On water-logged ground or grassy margins of tanks, etc.

Specimens : *B.N.H.S.* : o? 8-3-24, ♀ 11-3-24 Pāli Hill, Bandra (S.A.); o? 7-3-10 Gōrēgāon (N. B. Kinnear); *St. X. C.* : 114 o?, 116 o? 10-10-33, 152 ♀ 27-10-33 Jūhū; 227 o?, 228 ♂ 8-3-35 Andhēri (H.A).

Winter visitor. Common. Noted on open meadows by the seashore about Dānda and the Pāli Hill Golf Course, feeding in company with White Wagtails and Pipits. Latest date 31 March.

The Yellow-headed Wagtail : { *Motacilla citreola werae* Buturlin.
Motacilla citreola citreola Pall.

Field identification : Size as above. In summer the male of the race *werae* has a bright yellow head and black back. In *M. c. citreola* the back is not black. The females are duller. Usually by tanks and streams with grassy margins. Commonly on floating vegetation in Powāi Lake, etc.

Specimens : *M. c. citreola. B.N.H.S.* : oo 8-4-24 Mud Flats, Sion Causeway, o? 23-3-29 Tūlsi Lake, o? 10-3-24 Pāli Hill, Bandra (S.A.) ♂ 7-3-10 Gōrēgāon (Kinnear); o? 30-1-21 Santa Cruz (Ellison); ♀♀ 14-3-26 Mud Flats, Bhāyndar Creek; o? 17-3-24 Tūlsi Lake (S.A.).

M. c. werae : *St. X. C.* : 233 o?, 256 o? 22-3-35 Andhēri (H.A.).

Winter visitors. Fairly common.

It may here be remarked that in immature plumage many of the above species of wagtails are impossible to identify with certainty, and while they are probably correctly named as above, we are far from being positive.

The Forest Wagtail : *Dendronanthus indicus* (Gmelin).

Field identification : Size as above. Olive brown above, white below, with a conspicuous black band across breast. Two whitish bands on closed wing. Singly or pairs, feeding on ground under shady trees and vegetable 'māndwas' or bowers.

Specimen : *B.N.H.S.* : o? 30-3-24 Deonar, Chembūr (S.A.).

Not noted elsewhere in Salsette.

Winter visitor or passage migrant? Uncommon. At Kihim (Alibāg Talūka) —across the harbour—we have observed it only at the end of March and in the first week of April, evidently on northward passage.

When disturbed, the bird flies up into a nearby tree and wags its tail slowly up and down. It utters a soft *pink, pink* like the Crested Bunting.

The Tree Pipit : *Anthus trivialis trivialis* (Linn.).

Specimens : *B.N.H.S.* : ♀ 20-2-13 Santa Cruz (Kinnear); ♀ 4-2-24, ♀ 7-2-24 Golf Links, Pāli Hill, Bandra (S.A.).

Witherby's Pipit : *Anthus trivialis haringtoni* Witherby.

Specimen : *St. X. College* : 176 o? Vihār Lake 12-9-34 (H.A.).

Field identification : The Pipits found in Bombay and Salsette are all birds about the size of the House-Sparrow, somewhat slimmer and with a longer tail that is constantly moved up and down like a wagtail's. In general colouration they resemble the female House-Sparrow. They frequent open spaces such as maidans, golf links, the vicinity of tanks, and semi-barren stony ground. They feed entirely on the ground along which they *run* with great agility, unlike the sparrow which *hops*. They are usually seen singly or in small scattered parties. Their food consists mainly of insects. They fly up into trees when disturbed. They have the same undulating flight as wagtails. The different species are often impossible to tell in the field. Only one species, *rufulus*, is resident in our area.

Winter visitor. Earliest date 12 September. Usually found in shady mango topes.

The Indian Pipit : *Anthus rufulus rufulus* Vieillot.

Specimens : o? 17-3-24 ; ♂ 2-4-24 Pāli Hill, Bandra ; ♂ 15-6-25, ♂ 21-6-25 Trombay Hill at ca. 1,000 ft. ; ♂ 10-11-27 Mud Flats, Sion Causeway (S.A.) ; ♀ 20-1-13, ♂ 12-11-12, ♂ 20-2-13 Santa Cruz (Kinnear) ; oo? 12-12-99, 14-12-99 Esplanade, Bombay (J. W. Mason) ; *St. X. C.* : 208 ♀ -12-34 Andhēri (H.A.).

Resident. Common. Seen in open fallow land with short grass, stones, etc.

Breeding : On 15 April (1931) a nest was located on the coarse grass land, inundated during the monsoon but now hard and pitted, adjoining the Santa Cruz Match Works, opposite the Jūhū aerodrome. It was a pad of rootlets and hair placed in an old hoof-print of cattle. It contained 3 chicks about a week old.

The Eastern Tawny Pipit : *Anthus campestris griseus* Nicoll.

Specimens : *St. X. C.* : 14 o? (worn juvenile plumage) 14-10-32 'Salsette'; 18 ♂ 13-1-33, 166 ♀ 13-11-33, 199 ♀ 27-9-34, 226 ♂ 13-11-35 Andhēri (H.A.).

Blyth's Pipit : *Anthus campestris thermophilus* (Jerdon).

Specimens : *St. X. C.* : 155 ♀ 31-10-33 Jūhū (H.A.).

Both these races of the Tawny Pipit visit our area during the winter. *Griseus* appears to be by far the commoner. H.A. finds that it is possible to differentiate Tawny Pipits from the Indian Pipit in the field by the brighter coloured legs and more 'nasal' notes of the former.

The Small Indian Skylark : *Alauda gulgula gulgula* Franklin.

Field identification : Somewhat smaller than the House-Sparrow but in general appearance not unlike the female of that bird. Rather squat and with a shorter tail. Pairs or small parties, about the tidal mud flats, in the rank grass patches bordering salt pans, and in the surrounding fields. Males soaring, 'hovering' and singing.

Specimens : *B.N.H.S.* : ♂♂ 10-11-27 Mud Flats, Sion Causeway (S.A.) ; ♀ 7-4-24 Andhēri (S. H. Prater) ; *St. X. C.* : 43 o, 198 o, 203 o Salsette (H.A.).

Resident. Common. It is plentiful in short grass near the Golf Course at Andhēri.

Breeding : On 11 April (1934) H.A. flushed a bird off a nest with c/2, slightly set, at Andhēri. The nest was cup-shaped, made of grass and buttressed with pieces of thick grass stems. It was placed in the shelter of a grass tussock. On 26 April he noted flying young, and has a record of a bird feeding fledged young out of nest on 30 September (1935) on the Churchgate Reclamation. On 10 June (1930) S.A. observed an adult feeding a full-fledged young one, about 3 weeks old, in among cut paddy fields. The season, therefore, appears to be a prolonged one in our area, April to October.

The Short-toed Lark : *Calandrella brachydactyla dukhunensis* Sykes.

Field identification : Somewhat smaller than the House-Sparrow and not unlike the Skylark to look at except that it is more whitish underneath. Large flocks in open country, about mud flats and fallow fields.

Specimens : *St. X. C.* : 106 ♂, 107 ♂, 108 ♂, 109 ♂, 110 ♀, 111 ♀, 8-10-33, 165 ♂ 10-11-33 Andhēri (H.A.).

Winter visitor. Fairly abundant in Salsette and on the mainland across the harbour chiefly between November and January. The flocks keep to open, stony, scraggy grass-covered country, tidal mudflats and stubble fields. Occasional chirps are uttered in flight. They drink regularly in the mornings and have favourite watering places at which enormous numbers foregather for the purpose.

The Malabar Crested Lark : *Galerida malabarica* (Scop.).

Field identification : Size about that of the House-Sparrow. General appearance above, streaked brown somewhat like the female of that bird. Breast streaked black. Small parties or scattered flocks on the dry open ground about tidal mudflats and creeks, and on the scraggy grass-covered hills as at Trombay.

Specimens : *B.N.H.S.* : ♂ 22-3-24 Gōdhbunder, o? 6-4-24 Sion Causeway, o? juv. 15-6-25 Trombay Hill at ca. 800 ft. (S.A.) ; ♂ 30-12-23 Andhēri

(Prater); ♀ 5-11-12, ♀ 18-1-13, ♂ 6-4-13 Santa Cruz (Kinnear); *St. X. C.*: 56 ♂, 57 ♀ 21-8-33 Andhēri, 232 ♀, 235 ♂ 24-4-35 Gōrēgāon (H.A.).

Resident. Common. Larger flocks are seen during the cold weather, and at that season evidently some local movements take place in Salsette. We have observed these larks feeding on the seeds of *Spermacoce stricta* picked off the living plant.

Breeding: In Salsette S.A. has noted fledglings out of nest on 15 June. At Thal (Kolāba District) on the sea-coast—across the harbour—H.A. found a nest with 2 young on 25 October. Both parents were bringing in caterpillars. The nest was a shallow cup of grass placed under a stone, in open stony land. The mouth-colour of the nestlings was a bright orange red and the tongue (of the same colour) had 3 conspicuous black spots upon it.

The Indian Rufous-tailed Finch-Lark: *Ammomanes phoenicura phoenicura* (Franklin).

Field identification: Somewhat larger than the House-Sparrow. A plain dark brown sparrow-like bird, rather squat, with a black-tipped bright rufous tail conspicuous in flight. Pairs, running about on fallow land near the tidal mudflats, stubble fields, etc.

Specimens: *B.N.H.S.*: ♀ 10-11-27 Mud Flats, Sion Causeway (S.A.).

Resident. Fairly common. Feeds on the ground upon grass seeds, paddy grains, etc. and also insects. We have frequently observed its habit of rapidly opening and shutting its wings as it moves about in search of food. This manoeuvre is effective in dislodging lurking insects from the little unevennesses of the ground.

Males are usually seen, apparently even in the non-breeding season, rising into the air every now and again and rocketing downwards in steps—nose-diving—with wings pulled in to the sides, and singing on each dive.

Breeding: This is a most elusive and circumspect species when breeding and we have not as yet succeeded in marking down a nest in Salsette although between March and May we have several records of birds carrying building material or food for the young.

The Ashy-crowned or **Black-bellied Finch-Lark**: *Eremopterix grisea grisea* (Scopoli).

Field identification: A squat, finch-like bird, rather smaller than the House-Sparrow, seen in pairs, parties or small flocks on mudflats and open stony country. The male has black underparts, ashy crown and sandy hen-sparrow-like upper plumage. The female is sandy hen-sparrow-like all over.

Specimens: *B.N.H.S*: o? 27-2-24 Pāli Hill, Bandra; o? 7-6-25 Trombay Hill at ca. 900 ft. (S.A.); ♂ 30-1-21 Santa Cruz (B. C. Ellison); ♂ juv. 11-11-12; ♂♂ 11-10-12, ♀ 19-1-13, ♀ 25-1-13 Santa Cruz (Kinnear); ♂ imm. 21-1-11 Bombay (P. F. Gomes); *St. X. C.*: 67 ♂ 8-9-33 Andhēri (H.A.).

Resident. Common. Males constantly soar into space on quivering wings for about 30 feet or so, and sing. The same sort of aerobatics are indulged in as by the Rufous-tailed Finch-Lark, namely shooting up almost perpendicularly and nose-diving in steps with closed wings. In the final step it looks perilously as if the bird was going to dash itself to smithereens on the ground, but the wings are opened out at the last moment and it alights safely on a clod or stone. The grace and ease with which all these moves are executed are a delight to watch. There is a very marked decrease in the numbers of these larks in Salsette during the monsoon months—June to September—and evidently they then emigrate into drier country as in the Deccan. By about the beginning of October the birds are back again in considerable numbers.

Breeding: We have seen many nests in all stages of construction or with eggs and young in Salsette during March and April. There is a fledgling in the Society's collection dated 11 November and another immature bird 21 January. This indicates that the birds are double brooded, i.e., some breed in the earlier part of the year and some in the latter part. The nest is a tiny cup-like depression in the ground, lined with fine grass or tow, under the shelter of a stone or small bush in open country. It is usually rimmed with gravel or small stones. In our area c/2 seems to be invariable. The commonest colouration of the eggs is a pale yellowish stone, blotched and speckled with brownish-lavender.

The White-eye : *Zosterops palpebrosa occidentis* Ticehurst.

Field identification : Size about half that of the House-Sparrow. A tiny bird greenish-yellow above, bright yellow and greyish-white below, with a conspicuous ring of white feathers round the eyes. Slender slightly curved bill. In flocks, in trees and bushes in wooded country and gardens. A pleasant but feeble tinkling or cheeping call, sometimes like a miniature woodpecker 'laugh'.

Specimens : *B.N.H.S.* : ♂ 25-3-29 Tūlsi Lake (S.A.); *St. X. C.* : 242 o? 24-11-35 Borivli (H.A.).

Noted : *City* : Warden Road, Cumbala Hill; Government House Grounds, Malabar Hill; *Salsette* : Gōdhbunder, Chembūr, Powāi Lake environs, Shendūr Hill; common on mainland across the harbour.

Resident. Not uncommon in suitable localities. Feeding largely on the nectar of various flowers. Almost invariably present on those of *Bombax, Erythrina, Woodfordia, Calycopteris floribunda* and *Loranthus* clumps. Of the last particularly, it is an important cross-pollinating agent. Flocks move about from tree to tree, keeping up their musical cheeping calls and often clinging upside down on the sprigs in search of insects. They are very partial to the sticky exudation from the petioles of Banyan (*Ficus bengalensis*) leaves.

Breeding : Although we have no actual record, we have no doubt that the White-eye nests in Salsette. The specimen of 25 March had enlarged gonads and was evidently preparing to breed. During the breeding season the male develops a pretty, rather feeble, tinkling song reminiscent of the Nilgiri Verditer Flycatcher's. This is uttered from some exposed perch.

Vigors' Yellow-backed Sunbird : *Æthopyga siparaja vigorsi* (Sykes).

Field identification : Size same as the White-eye or the Purple or Purple-rumped Sunbird. A tiny restless gem of a bird with metallic green head, crimson back, bright yellow rump and crimson-scarlet breast. Longish pointed tail. The female is olive-brown and pale dull yellow, not unlike the female Purple Sunbird. Singly, in wooded hilly country, usually on flowers of *Woodfordia, Bombax* and others.

Specimens : *B.N.H.S.* : ♂ 15-11-25, ♂ 29-11-25 Gōdhbunder; ♂ 8-12-25, o? 3-3-29 Tūlsi Lake Environs (S.A.); *St. X. C.* : 158 ♂ 9-11-33 Powāi Lake environs (H.A.).

Noted : *Salsette* : Chembūr, near Kanhēri Caves; *Adjacent mainland* : Tānsa Lake, Karnāla Fort, Panvēl (Kolāba District).

Resident? Not uncommon in the well-wooded hilly country in North Salsette, especially in the environs of Powāi, Tūlsi and Vihār Lakes, and about Gōdhbunder. All our records seem to be for the winter months only.

Breeding : We have no record from Salsette. In the Western Ghāts, Wenden (*N. & E.*, ii, 250) found a nest—17 September—on the face of a cutting at the upper entrance of Bhōr Ghāt Tunnel No. 19 with c/3, fresh. Another nest was found by him in the same locality on 21 September.

Loten's Sunbird : *Cinnyris lotenia* (Linn.).

Field identification : Size as above. Adult male black with metallic green and purple sheen, a maroon band across the breast and yellow tufts at the 'armpits'. Underparts sooty brown without gloss. Female brown to olive-brown above, pale dull yellow below. Singly or pairs, in wooded country on trees, shrubs, creepers and *Loranthus* clumps in flower.

Specimens : *B.N.H.S.* : ♂ 16-3-24 Vihār Lake (S.A.); ♂ 4-1-13 Santa Cruz (Kinnear); *St. X. C.* : 99 ♀, 100 ♂ (testes 4 × 3 mm.) 28-9-33 Borivli (H.A.).

Noted : *Salsette* : Chembūr, Andhēri, Powāi, Tūlsi, Marōl : *Adjacent mainland* : Karnāla Fort, Bassein, Alibāg. Aitken (*N. & E.*, ii, 252) describes it as not uncommon at Uran on the island of Karanja (Bombay Harbour).

Resident. Common. We have not observed it within city limits, but while it is certainly more partial to wooded country farther afield, it is just possible that it may have been overlooked here.

Sunbirds of all species feed largely on the nectar of flowers and are directly responsible for the cross-pollination of many species. In probing into the flower tubes for nectar with its well adapted slender curved bill, the forehead comes into contact with the anthers and a quantity of the ripe pollen adheres to the feathers. This is transferred to the stigma of the next flower visited.

Their visits to the flowers are thus of vital benefit to the tree. Spiders and small insects usually taken at the flowers, are also eaten.

Breeding: On 14 July (1934) H.A. observed a ♀ building on a tree in forest at Tūlsi, ca. 20 ft. up. He found a nest at Powāi Lake on 5 March containing 2 fledglings which both parents were busy feeding. It was the usual sunbird structure—an oblong purse of soft grasses, rubbish and cobwebs, draped with pieces of bark and woody refuse,—with a porched lateral entrance—hung 18 inches from the ground in a bare thorny bush. On 3 May a male was observed courting a female. The tufts of yellow feathers under the 'armpit' are erected during the display to such an extent that they become strikingly conspicuous even from over the bird's back. A second nest with c/2 was noted at Mulund on 26 June (32) It was about 7 ft. up, in close proximity to a nest of red ants (*Œcophylla smaragdina*) and apparently at peace with it.

Aitken (*J.B.N.H.S.*, ii, 52) took a nest containing 1 egg and 1 young just hatched at Uran (Bombay Harbour) in November (1886). He describes the eggs as of a dirty brownish-white ground colour with the smaller end covered with dull brown spots passing into large confluent blotches and forming a cap on the broader end.

From the evidence it is clear that the season in Salsette is not well defined.

The Purple Sunbird : *Cinnyris asiatica asiatica* (Latham).

Field identification: In size and general appearance very similar to Loten's Sunbird. Differs from it in having a metallic purple sheen instead of green, in the absence of the maroon band across breast, and in the underparts being glossy purple-black instead of dull sooty-brown. It also has the yellow and scarlet feather-tufts at the armpit. Female very like that of *C. lotenia.* Similar to the foregoing in habits and habitat except that it is met with oftener in gardens, both in the city and suburbs.

Specimens: *B.N.H.S.*: ♂ 2-6-25 Malād (E. Henricks); ♂ 28-8-21 Bhāndūp (G. C. Amore); ♂ 7-2-13 Andhēri (Kinnear); ♂ 17-11-27 foot of Trombay Hill (S.A.); *St. X. C.*: 161 ♂ 9-11-33 Powāi Lake (H.A.).

Resident? Common.

Noted: *City*: Girgaum, Bhūlēshwar, Byculla, Chowpāti, Wālkēshwar, Malabār Hill, Warden Road etc.; *Salsette*: Pāli Hill, Bandra; Khār, Gōrēgāon, Borivli, Kandivli, Chembūr, Gōdhbunder, Thāna and elsewhere generally.

An unfailing attendant on flowering trees, shrubs and creepers in gardens. Along with the Purple-rumped species, it is invariably present on the blossoms of the Drumstick tree (*Moringa oleifera*) and on those of the tree parasite, *Loranthus.* For the latter it is a most important cross-pollinating agent. Breeding males, and those about to breed, habitually perch on the topmost branches of a tree, a telegraph wire or in some other exposed situation and utter their excited 'song' *cheewit-cheewit-cheewit,* repeated in quick succession from 2 to 6 times. While thus engaged the bird pivots from side to side and nervously raises and lowers his wings.

Breeding: Curiously enough we have no record of its nest from our area or from our immediate neighbourhood. Is it a local migrant?

The Purple-rumped Sunbird : *Cinnyris zeylonica* (Linn.).

Mahratti name: *Chūmka*; Hindūstāni: *Shakar-khōra.*

Field identification: Size as last. Head, upper plumage and breast mostly metallic green, crimson and purple. Rump metallic bluish purple. Lower parts bright yellow. Female sober olive-brown and dull yellow as with the other sunbird species. Habits and habitat same as in the previous species, but this is even more common by human habitations.

Specimens: *St. Xavier's College*: 25 o? juv. 3-8-33, 26 ♀ juv. 10-9-33 Andhēri; 55 ♂ 20-8-33 Chendevli (H.A.).

Noted: *City*: Girgaum, Khētwādi, Chowpāti, Bhūlēshwar, Byculla, Wālkēshwar, Malabār Hill, Fort (Prince of Wales Museum garden), Warden and Pedder Roads, Apollo Bunder, Colāba and elsewhere. Common everywhere in the suburbs and Salsette.

Resident. Very common. Its notes and song are, with a little practice, easily distinguishable from those of the Purple Sunbird.

Breeding: We have records of numerous nests in Bombay City and Salsette either under construction or with eggs or young in January, February, April, May, July, August, September and October. The period from July to September, however, is when breeding is at its height. The nest is like that of Loten's Sunbird. It is usually suspended from the tip of an outhanging branch at moderate heights—between 6 and 12 feet. It is frequently built in creepers growing on the trellis work of verandahs of inhabited bungalows and the birds do not seem to mind the proximity of human beings. Building work is done solely by the female, but the male usually accompanies her to and from the nest while she is at work, encouraging her as it were by little snatches of song from a nearby perch. The male does not share in the incubation which takes 14-15 days. Both parents feed the young. These leave the nest when 16-17 days old. We have invariably found 2 eggs or young in our area. In ground colour the eggs are usually grey with a greenish or buff tinge; they are flecked and speckled with greyish-brown, more profusely round the broader end.

Tickell's Flowerpecker : *Dicaeum erythrorhynchos erythrorhynchos* (Latham).

Field identification : Somewhat smaller than a sunbird. A restless olive-brown bird with grey-white underparts and flesh-coloured slender bill. Singly, usually on clumps of the tree parasites *Loranthus* and *Viscum* on mango trees, hopping about energetically and uttering *chip, chip, chip,* etc.

Specimens : *B.N.H.S.* : o? 16-2-24 Pāli Hill; o? 8-12-25 Gōdhbunder (S.A.); *St. X. C.* : 97 ♀ 28-9-33 Borivli (H.A.).

Noted : *City* : Government House Grounds—Wālkēshwar; Victoria Gardens—Byculla, Chowpāti, Colāba, Malabār Hill; *Salsette* : common everywhere.

Resident. Common. Especially plentiful in orchards where *Loranthus* and *Viscum* abound on the mango trees. It fertilises the *Loranthus* blossoms in its attempts to reach the nectar, and eats the berries of both almost exclusively when available. It is thus perhaps the most important agent in the spread of these parasites in Salsette.

Breeding: According to EHA (*C.B.B.*, p. 68) the breeding season here is March and April. H.A. has taken fresh eggs at Andhēri on 4 February ('33) and also on 7 March ('36) at Powāi. On 26 April ('36—Borivli) he observed a bird visiting a nest in a high tree evidently containing young, and on 5 May a young bird just out of nest was being fed by its parents.

The nest of Tickell's Flowerpecker is a hanging oval purse like that of a sunbird but somewhat smaller and of neater appearance. It is made of soft fibres and vegetable down and not draped on the exterior with rubbish. It may be at any height from 10 or 15 to 40 feet. Both sexes build the nest and feed the young. The normal clutch is of 2 eggs, white in colour, unmarked.

The Thick-billed Flowerpecker : *Piprisoma agile agile* Tickell.

Field identification : Size and general appearance of the last, but the underparts faintly streaked brown. The bill is thick and finch-like and of a slaty-grey colour. Singly, in same facies as Tickell's Flowerpecker and very similar to it in habits.

Specimens : [*St. X. C.* : 139 o 21-10-33 Kihim (Alibāg, Kolāba District).] None collected in Salsette.

Noted : *Salsette* : Powāi Lake environs, Chembūr, Andhēri, Borivli. Not within city limits.

Resident. Not uncommon. Its food consists largely of the berries of the tree parasites *Loranthus* and *Viscum,* and it shares with Tickell's Flowerpecker the responsibility for their spread and for the resulting damage to mango orchards. Other berries such as those of *Lantana camara* and *Bridelia retusa* are also greedily taken, as well as Peepal and Banyan figs. *Bombax* and *Erythrina* flowers are regularly resorted to for the nectar, and spiders likewise form part the dietary. It utters *chik, chik* as it restlessly hops about the foliage, but its notes are easily distinguishable from those of the previous species. While thus engaged, it spreads out its stumpy square little tail and screws it nervously edgewise from side to side.

Breeding: On 5 March ('36—Powāi) an adult was observed feeding two juveniles just out of nest. On 24 April ('36—Andhēri) a bird was building ca. 15 ft. up in a *Ficus* of sorts. Red Ants (*Œcophylla*) were swarming on this tree but apparently did no harm to the nest. On 2 May the eggs, c/3—partly set—were removed from this nest. On 3 May ('36—Borivli) another nest was noted in an *Erythrina* tree also about 15 ft. up. The nest—a hanging oval purse of reddish vegetable down, about 4 inches long—is not intentionally concealed, but is usually so cryptically coloured that at a casual glance it looks like a dry rolled-up leaf. It is usually suspended from near the tip of an outhanding twig. The attachment is not from a point but is about 2 inches wide along the length of the twig. C/2 or c/3 is the normal. The eggs are pinky-white or salmon in ground colour, speckled and blotched with reddish- or purplish-brown.

The Indian Pitta : *Pitta brachyura* Linn.

Hindūstāni name : *Nowrang* (=9 colours).

Field identification : Size about that of the Myna. Stub tail. A gaudily coloured bird mostly green, blue, crimson, fulvous and black. Singly, on the ground amongst scrub undergrowth in jungle. When disturbed, it flies up into low trees with a whirr of its wings like a slow game bird.

Specimens : *B.N.H.S.* : ♀ 2-6-25 Bombay (J. Azavedo); o? 4-6-21 Bombay (B. C. Ellison).

Noted : *City* : Colāba, Malabār Hill; *Salsette* : Pāli Hill, Bandra; Gōdhbunder, Powāi Lake Environs. Not uncommon on the mainland across the harbour in the monsoon.

Monsoon visitor. Its arrival in Bombay and Salsette, presumably from South India, synchronizes more or less with the South-west Monsoon. We have noted it here between 15 May and 15 October (one on 28 April at Alibāg!) although by about mid-September most birds have departed. We really know very little beyond conjecture about the local movements of the Pitta, and here is a problem which only the ringing method can help to solve. The House-Crows of the city and suburbs are usually the first to herald the arrival of the birds by their relentless persecution of them. Many a refugee is picked up every year, disabled by these blackguards or caught in a room into which it has blundered to escape its pursuers. Its call is a loud clear double whistle *wheet-tew* heard mostly in the early morning and late evening, and also on cloudy overcast days. These calls are uttered at the rate of about 3 or 4 in 10 seconds and are sometimes kept up for over 5 minutes at a stretch. Each time the bird calls it pulls itself upright and jerks its head well back as when swallowing water. In between the calls the stumpy tail is wagged slowly and deliberately up and down. The bird progresses on the ground in search of insects by long hops, like a thrush.

Breeding : On 3 June ('36—Powāi) H.A. observed a bird building in a *Loranthus* clump on a mango tree about 30 ft. up. The tree was situated in a patch of fairly open country near a village. The bird was busy collecting sticks from the ground nearby, one of which was over a foot long.

The nest of the Pitta is a deep cup of twigs and rootlets, domed and often larger than a football. We have no other record of its nesting in our area.

The Southern Yellow-fronted Pied Woodpecker : *Dryobates mahrattensis mahrattensis* (Latham).

Field identification : Size about that of the Bulbul. Spotted black and white plumage with yellowish-brown crown and scarlet patch on abdomen. In the male the hind crown is also scarlet. Long, stout, pointed bill and stiff, wedge-shaped tail. Singly or pairs, in orchards and wooded country. Clinging to trunks or branches of trees and scuttling upwards in spurts and spirals, tapping the bark at intervals. Flies with rapid wing-beats interspersed with pauses.

Specimens : *B.N.H.S.* : ♂ 11-3-24 Pāli Hill, Bandra (S.A.); ♀ 30-1-21 Santa Cruz (Ellison); ♂ 19-1-25 Andhēri (H. Hearn). *St. X. C.* : 255 ♀ juv. 8-3-36 Powāi Lake Environs (H.A.).

Noted : *City* : Warden Road, Fort, Colāba. *Salsette* : Chembūr, Gōdhbunder, Borivli, Mulund, etc.

Resident. Fairly common. The call note is a sharp *click click* or *clik-r-r-r-r*. We have occasionally observed it feeding on the nectar of *Bombax* and *Erythrina* flowers.

Breeding : EHA (*C.B.B.*, p. 59) says they breed here in February and March. We have seen a nest with young—both parents bringing caterpillars, etc.—on 21 March ('26—Chembūr). It was in a more or less horizontal mango branch about 12 feet above the ground, with the entrance hole on the underside.

The parent birds were very circumspect, and both before and after their visits to the nest-hole kept hopping about the adjacent branches for a considerable while.

The Rufous Woodpecker : *Micropternus brachyurus jerdonii* (Malherbe).

Field identification : Size about that of the Myna. General colour chestnut-rufous. A typical woodpecker with stout straight, pointed bill and stiff wedge-shaped tail. Singly or pairs, in orchards or lightly wooded country.

Specimens : *B.N.H.S.* : ♂ 15-1-24 (Prater), ♀ 9-2-08 (Kinnear) Andhēri; *St. X. C.* : 167 ♀ 19-11-33 Borivli (H.A.).

Noted : *Salsette* : Chembūr, Trombay, Mulund.

Resident. Fairly common. Its food in our area consists to a very large extent of *Crematogaster* ants and their larvæ. To get at the insects, the bird perches in the passerine manner across a branch adjoining the carton-like arboreal nest of the ants, and digs into it with its bill. The ants are picked off as they swarm to the site of the disturbance. In a garden at Deonar (Chembūr) we have on several occasions observed it clinging on the stems of banana trees and probing into the soft tissues near the bases of the leaves, evidently for the sap. One was noted eating a Banyan fig perched like a barbet across a branch. Its call is a high-pitched *ke-ke-ke-ke* something like the Myna's. The alarm note is a quick, low *qū-ūk*.

Breeding : The Rufous Woodpecker is remarkable for habitually utilising the carton-like nests of *Crematogaster* ants for its own. H.A. has found 2 such nests in Salsette (19 April '35 and 31 March '36—Borivli) at heights of about 20 and 25 feet. Unfortunately both these were empty at the time, but the birds were flushed from within. The ants' nests had been hollowed out and a neat round entrance hole was made in them at the side. H.A. noted that the nests were alive with ants at the time!

N. F. T. Wilson (*J.B.N.H.S.*, xi, 744) found this woodpecker breeding at Thāna in April.

The Golden-backed Woodpecker : *Brachypternus benghalensis puncticollis* (Malherbe).

Mahrātti name : *Bhandāri.*

Field identification : Size slightly larger than that of the Myna. Head black and white, with a crimson crest. Back and upper parts of wings golden yellow. Underparts whitish with black streaks. The female has no crimson in the crest. Singly or pairs, in wooded country, mango orchards and cocoanut groves, clinging to the tree-trunks, running up or backing down them in jerks and spirals and tapping the bark for insects. Flight of rapid wing-beats with pauses, usually accompanied by a loud, harsh chattering call or 'laugh'.

Specimens : *B.N.H.S.* : ♀ 10-4-93 ; *St. X. C.* : 539 o?.

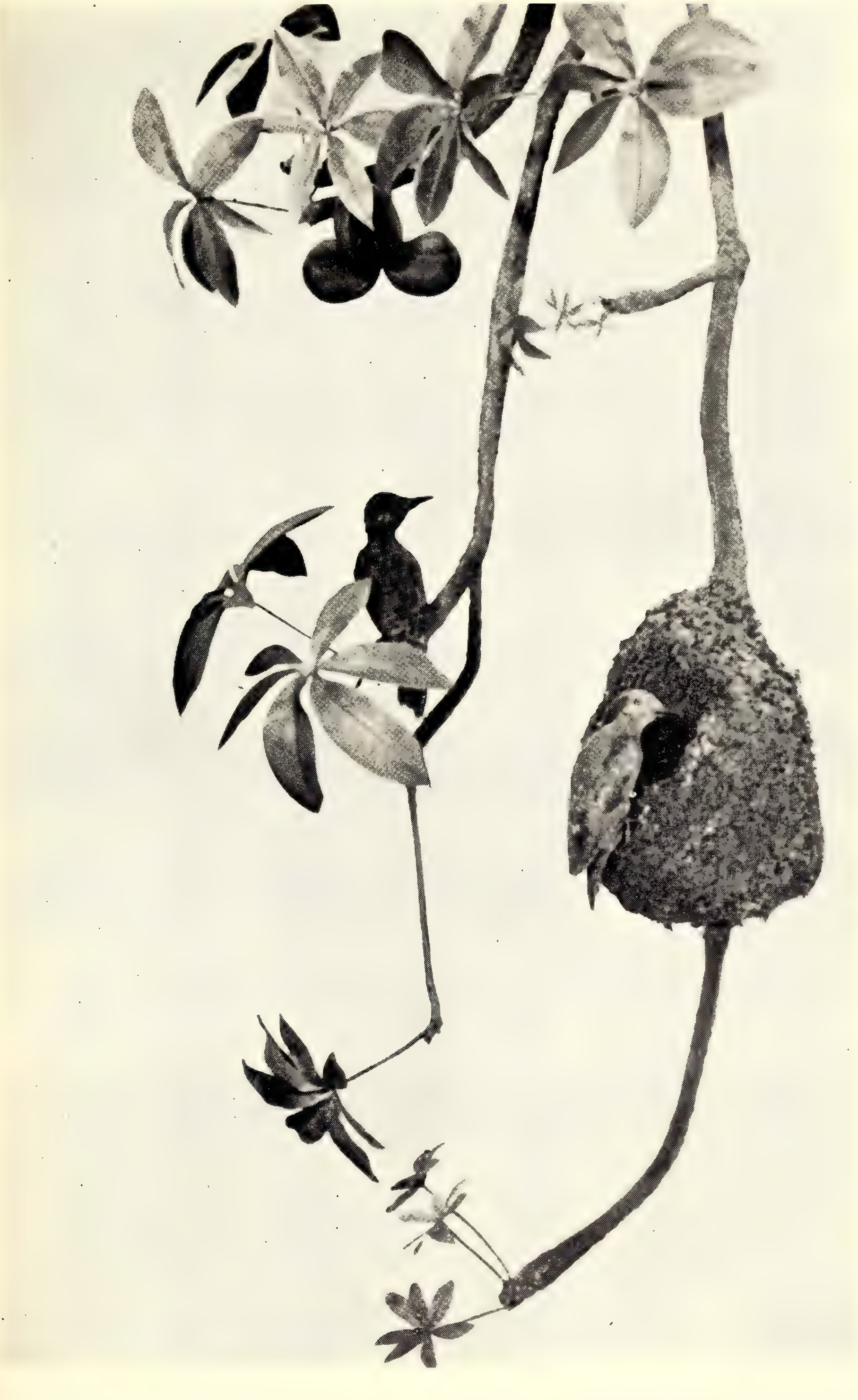
Noted : *City* : Warden Road, Wālkēshwar, Malabār Hill. *Salsette* : Chembūr, Pāli Hill, Khār, Andhēri, Borivli, Gōdhbunder, Tūlsi Lake environs, Jūhū, Māhim.

Resident. Fairly common. Its food consists largely of large black ants (*Camponotus* sp.) picked off the ground or on trees. We have observed it feeding on nectar from the blossoms of *Erythrina indica* and drinking rain water collected in the casing of the inflorescence of a cocoanut palm.

Breeding : The only two nests of this species we have come across in our neighbourhood were at Kihim (Alibāg Talūka) across the harbour. One (9 April) was in a decaying cocoanut trunk about 18 ft. up and contained young which both parents were busy feeding. The nest was evil-smelling and the young made a screechy hissing sound when approached. The second nest was in a hole in the vertical stem of an Oondi tree (*Calophyllum inophyllum*) about 8 ft. from the ground. On 13 May ('31) this contained 3 fresh eggs. The nest hollow was about 15 inches deep and unlined. The brooding bird sat so close that it was caught by hand. The eggs are roundish ovals, glossy china white, unmarked.

The Black-backed Woodpecker : *Chrysocolaptes festivus* (Bodd.).

Field identification : Size as the foregoing. Similar to it in general appearance except that the back is black instead of golden yellow. Upper parts of the wings golden-olive. Crown and crest crimson in male, golden yellow in female. Singly or pairs in thin jungle.



Nest of the Rufous Woodpecker [*Micropternus brachyurus jerdoni* (Malherbe)] in carton-like nest of Crematogaster ants.

(Photograph of an exhibit in the Bird Gallery, Prince of Wales Museum, Bombay.)

Specimens: *St. Xavier's College*: 94 ♂ 28-9-33 Borivli (H.A.).

Noted: In the environs of Powāi and Tūlsi Lakes.

Resident. Not uncommon in parts of N. Salsette. Pairs keep in touch with each other by means of a *ch-chrr-chrk* call. The usual chattering call is something like that of the Golden-backed Woodpecker, but louder and more 'nasal'.

We have no records as yet of its breeding within our area.

The Malabar Heart-spotted Woodpecker: *Hemicircus canente cordatus* Jerdon.

Field identification: Size about that of the Bulbul; squatter and with a shorter and wedge-shaped tail. Black above, including crest, dark olive below. White-speckled forehead in male, buffy-white in female. Whitish rump and some white in wings. Chin, throat and sides of neck buffy white. A smallish pied bird with a large head and thin neck, clinging to, and running up and down or around the branches of trees and shrubs in forested hilly country.

Specimen: *St. X. C.*: ♀ 24-11-35 Borivli (H.A.).

Noted: Tūlsi Lake environs (once only).

Presumably resident. Rare; unknown in these parts until the specimen was obtained.

Breeding: The gonads of the specimen measured 6×4 mm. It was flushed from within a nest-hole in a rotten branch, about 12 ft. up, in light forest.

The Wryneck: *Iynx torquilla torquilla* Linn.

Field identification: Slightly bigger than the House-Sparrow. Above grey-brown with black markings; below whitish with black arrow-head markings producing a cross-bar pattern. Colour scheme of back very like a nightjar's. The peculiar dipping flight and general behaviour rather finch-like. Singly, in small tree- or scrub- jungle especially babool and date. Often hopping on ground in search of insect food.

Specimens: *B.N.H.S.*: ♀ 8-3-24 Pāli Hill, Bandra (S.A.); oo? 21-3-24 Chembūr (S.A.); ♂ 31-8-06 Fort, Bombay (L. H. Saville); *St. X. C.*: 82 ♂ 22-9-33 Jūhū (H.A.).

Noted: Khār, Andhēri, Gōdhbunder.

Winter visitor. Fairly common though unobtrusive. Earliest record 31 August; latest 9 April. Its call is a feeble but rapid, high-pitched *chk-ch-ch-ch*, etc. like that of the smaller woodpeckers. Its food consists largely of the small black terrestrial ants. The stomach of a specimen contained over 500 of these insects. The birds appear to localise themselves and may be found in the same patch of country day after day.

The Bombay Green Barbet: *Thereiceryx zeylanicus inornatus* (Walden).

Mahrātti name: *Kokrus.*

Field identification: About as big as the Myna. An ungainly grass-green bird, paler underneath, with streaked brownish head, neck, breast and upper back. Heavy conical orange-brown bill with coarse bristles at the base. A bright orange naked patch round the eye. Singly or parties, on Banyan and other forest trees in fruit, in well-wooded country. Heavy noisy flight.

Specimen: *St. X. C.*: 93 ♂ 28-9-33 Borivli (H.A.).

Noted: Vihār, Tūlsi and Powāi Lake environs; Borivli, Kandivli, Gōdhbunder.

Resident. Common in the wooded hills of North Salsette and in the 'lake district'. Its call *kr-r-r-r, kūtroo, kūtroo, kūtroo,* etc. resounds in these localities. As soon as one bird begins calling, a second invariably takes it up at once. The sudden report of a gun will set off half a dozen birds calling! Its food consists of *Ficus* figs and berries of many kinds. We have also observed it at the flowers of *Erythrina stricta* for the nectar.

Breeding: We have not taken any nests in Salsette, but on 21 March ('35—Gōdhbunder) a bird was observed entering a nest-hole in a dead stump about 15 feet up.

The Crimson-breasted Barbet or **Coppersmith**: *Xantholoema haemacephala indica* (Latham).

Mahrātti name: *Sonār.*

Field identification: Slightly larger and dumpier than the House-Sparrow. A grass-green bird with bright crimson forehead and a patch of the same colour on the breast. Below, yellowish-white streaked with green. Naked skin round eye dull crimson. Bill heavy, with coarse hairs at base. Short square tail appearing triangular in flight. Singly or loose parties, in Banyan and other trees in fruit, both within and outside city limits.

Specimens: *B.N.H.S.*: ♂ imm. 28-5-15 Bombay (Kinnear); *St. X. C.*: ♂ 22-2-33 Andhēri (H.A.).

Noted: *City*: Bālārām Street and Sleater Road—near Grant Road; Warden Road, Chowpāti, Bhūlēshwar, Fort, Colāba, Government House Grounds—Wālkēshwar, Victoria Terminus, Cruikshank Road and elsewhere. Common everywhere in Salsette.

Resident. Very common. Its monotonous ***tŭk-tŭk-tŭk*** as of a coppersmith at work, may be heard in the busiest parts of the city and vies with the shouts of vendors and traffic noises of every description. Its food consists of fruit of which *Ficus* figs form an overwhelming proportion. We have occasionally observed it launching ludicrous sallies after moths and winged termites. Aitken (*J.B.N.H.S.*, viii, 326) has also made a similar observation. We have noted a canary yellow specimen which was particularly conspicuous in its leafy environment.

Breeding: In Bombay City we have seen nests at Warden Road, Bālārām Street, Grant Road, Girgaum, Colāba, near Victoria Terminus, Khētwādi and Bhūlēshwar. Numerous others in the suburbs and Salsette. The principal breeding months here are February, March and April. One in Bombay City was excavating a hole on 25 August so it is probable that some birds breed later in the year also. The nest-holes are excavated in decayed vertical branches of trees usually at moderate heights, between 12 and 20 feet, by the birds themselves. Sometimes horizontal branches are used when the entrance hole is placed on the underside. Softwood trees such as *Erythrina, Moringa,* Mango and Karanj (*Pongamia*) are mostly selected for the purpose. The nest-hole is 6 to 8 inches deep; it is unlined and has a round entrance hole about 2 inches in diameter. Usually 2 or 3 eggs are laid, unmarked white, elliptical, and of a smooth texture. Both sexes feed the young.

[**The Cuckoo**: *Cuculus canorus* ssp.

Specimen: *St. X. C.*: o? juv. 20-10-33 Rēwas, Alibāg Talūka, Kolāba District (H.A.).

The above was shot off a wire fence near the Dharamtar Creek. As it is in juvenile plumage the race cannot be determined. H.A. has also observed (13 October) a Cuckoo at Bassein on the mainland immediately north of Salsette.]

The Indian Cuckoo: *Cuculus micropterus micropterus* Gould.

Field identification: Size about that of the Pigeon, somewhat slenderer and with a longer tail. Upper parts brown except head and neck which are ashy-grey. Breast pale grey. Underparts whitish, cross-barred with black. A black band across tail, near the tip. Singly, in wooded country.

Specimen: *St. X. C.*: 267 o? Powāi (H.A.).

Noted: Tūlsi Lake environs (30 July '35).

Status uncertain. Uncommon. Its call may be syllabified as *Cross-word-puzzle* or *What's your trouble*. H.A. likens it to that of the Scimitar Babbler (*Pomatorhinus horsfieldii*).

The Common Hawk-Cuckoo: *Hierococcyx varius* Vahl.

Field identification: Size and shape as last. Above ashy-grey, below whitish, cross-barred with brown. General colouration very like the Shikra's. Flight and movements also reminiscent of that hawk. Singly, in mango orchards and wooded country.

Specimens: *B.N.H.S.*: ♂ imm. 13-11-08 Pāli Hill, Bandra (Major H. J. Walton); *St. X. C.*: 172 ♂ 19-11-33 Borivli (H.A.).

Noted: Andhēri.

Resident? Not common. Its obstreperous and aggravating *brain-fever* calls usually begin to be heard in early May and continue right up to August or September. The bird is thus always more in evidence at this season and as it is likely to be overlooked at other times of the year, when silent, it is possibly less uncommon in our area than it appears.

Breeding: We have no evidence of its breeding here beyond the immature specimen in the Society's collection.

The Indian Plaintive Cuckoo : *Cacomantis merulinus passerinus* (Vahl.).

Field identification : Size about that of the Bulbul. Above dark ashy-grey, below paler. Tail blackish with white tip. White patch on wing noticeable in flight. Singly, in mango orchards and wooded country.

Specimen : *St. X. C.* : ♂ 7-8-33 Gōrēgāon (H.A.).

Presumably a monsoon visitor. Our records are only from the middle of May to the end of August (once heard 30 October). It is quite common in June in and about the scrub country along the base of Trombay Hills and at Powāi Lake, and its call is then on the air everywhere. It consists of several rather plaintive whistling notes : *Pee-pipee-pee, pipee-pee,* etc. When calling (from some exposed part of a tree) the tail is depressed and the rump slightly arched, with the wings drooping at the sides. Its food consists of grasshoppers, bugs and caterpillars. H.A. noted it gobbling up hairy caterpillars of the moth *Nepita conferta* swarming on a loose stone wall.

Breeding : We have no record from Salsette. In the Deccan it lays commonly in the nests of the Tailor-Bird and the Ashy Wren-Warbler, both of which are also breeding in Salsette while the cuckoo is with us.

The Indian Bay-banded Cuckoo : *Penthoceryx sonneratii* [*sonneratii* (Lath.) ?].

H.A. has only one sight record of a single bird of this species in Salsette : Tūlsi-Vihār Lake environs, 10 October.

The Drongo Cuckoo : *Surniculus lugubris lugubris* (Horsf.).

Field identification : Size of the Bulbul or Black Drongo, with the deeply forked long tail of the latter. In colour and appearance it is very like the Black Drongo and liable to be confused with it at a casual glance. If carefully watched, however, its flight and habits are distinctly cuculine. Singly, in well-wooded tracts, especially with an abundance of Tād or Palmyra palms (*Borassus flabellifer*).

Specimens : *B.N.H.S.* : o? 14-6-25 Trombay Hills, o? 21-6-25 Powāi Lake (S.A.) ; *St. X. C.* : 92 ♀ 27-9-33 (H.A.) This last is in heavy moult, hence the sub-species is unconfirmed.

Noted : *Salsette* : Borivli, Kandivli, Chembūr.

Monsoon visitor? We have recorded it here only between 2 June and 27 September. During this period it is greatly in evidence by virtue of its distinctive call of 6 (sometimes 7 or 8) short whistling notes. The notes—1-2-3-4-5-6, etc.—rise in scale and end abruptly. While calling, the body is carried in a horizontal position and its resemblance to the Drongo is then least pronounced. Occasionally it may be heard calling all night, but especially between 2 and 4 a.m. Its food consists principally of caterpillars, the hairy ones being much relished.

We are not satisfied with the suggestion that its close outward resemblance to the Black Drongo is of real advantage to the bird, and are unable to say as yet what the significance of it may be.

Breeding : We have no direct evidence of its breeding in Salsette. The specimen of 27 September, however, had a fully mature ovary with the largest follicles 3 mm. in diameter. This bird was obviously preparing to lay, inspite of the fact that it was in heavy moult at the time. Elsewhere, the eggs of this cuckoo have been recorded from nests of the Black Drongo and from those of the Iora and the Black-fronted Babbler (*Rhopocichla*).

The Pied Crested Cuckoo : *Clamator jacobinus pica* (Hempr. & Ehr.).

Mahrātti name : *Tiu.*

Field identification : Somewhat larger than a dove and with a longer tail. Black above—including crest—white below. A white roundish patch on wings conspicuous in flight. Singly or pairs, in and about groves of trees and in scrub country dotted with large trees. Usually very noisy while with us.

Specimens : *B.N.H.S.* : ♂ 10-6-15 Bombay ; o? 1-6-24 Pāli Hill, Bandra (S.A.) ; o? 7-11-00 Apollo Street, Bombay (E. Comber).

Noted : Khār, Andhēri, Borivli, Gōdhbunder, Chembūr.

Monsoon visitor. Common. Arriving at the end of May (earliest 25th) and leaving again by the end of October (latest 11 November). The birds are most abundant and noisy between 15 June and the end of August. Pairs are usually seen chasing each other and calling—a loud, rather plaintive, tinkling *piu, piu, pee-pee-piu, pee-pee-piu*, etc. Its food consists of hairy caterpillars, grasshoppers and other insects.

In Bombay City, the Pied Crested Cuckoos are much persecuted by the local House-Crows. The specimen of 7 November 1900 had taken refuge from them in the Society's Rooms at 6, Apollo Street. Similarly 3 such refugees were caught in St. Xavier's College and 2 in the Prince of Wales Museum between 25 May and 1 June (1936).

Breeding: We have no record from within the limits of Bombay and Salsette, but at Kihim (across the harbour—in Alibāg Talūka) we have found this species breeding from July to September. The usual host there is the Bombay Babbler (*Turdoides s. somervillei*). On 16 August a pair of Pied Cuckoos were observed in copula. A specimen shot on the 29th of that month had a complete oviduct egg of a pale blue colour. The laid egg is a deeper blue and approximates closely to that of the fosterer.

The Indian Koel: *Eudynamis scolopaceus scolopaceus* (Linn.).

Field identification: Somewhat larger than a dove and with a longer tail. Glossy black all over—like a slender Jungle-Crow—with a yellowish-green bill. The female is blackish-brown, spotted above and barred below with white. Singly or pairs, in gardens and groves of trees.

Specimens: *B.N.H.S.*: o? 22-5-16 Malabār Hill, Bombay (J. E. Needham); *St. X. C.*: 39 ♀ 1-8-33 Andhēri (H.A.).

Noted: *City*: Victoria Gardens—Byculla, Parēl (about Haffkine Institute), Government House Grounds—Wālkēshwar, Ridge Road and the neighbourhood—Malabār Hill, Fort. *Salsette*: Pāli Hill—Bandra, Khār, Borivli, Mulund, Bhāndūp, Gōdhbunder, Thāna, etc.

Resident. Common. It is, on the whole, silent during the winter months but becomes extremely obstreperous from March to July. At that season its shrill shrieking call: *kūoo, kūoo*, etc. resounds through the countryside all day. It begins on a low note, but rises in scale at each successive *kūoo* until at the seventh or eighth it reaches feverish pitch and breaks off abruptly. The bird soon begins it all over again, however. By an imitation of its calls, which the bird insists on answering, village boys are wont to drive the bird frantic and hoarse! It is perhaps the earliest riser amongst our local birds being usually up and calling long before the House-Crow and the Magpie-Robin, who tie for second place. We have frequently heard it as early as 3.45 of a summer morning. The female Koel utters a sharp *kīk-kīk-kīk* as it flies from tree to tree or hops about among the branches. Its food consists of hairy caterpillars and other insects, but a large variety of fruits and berries is also eaten, amongst which *Ficus retusa, F. bengalensis, F. religiosa, Bridelia, Streblus asper* and *Phyllanthus reticulatus* are common. We have observed it plucking and swallowing the nuts of the Fish-tail Palm (*Caryota urens*) and, on another occasion, a full clutch of eggs from a nest of the Red-whiskered Bulbul (*Otocompsa jocosa*).

Breeding: The laying season is in May and June and corresponds with that of its most usual host the House-Crow (*Corvus splendens*). Occasionally the Jungle Crow which nests somewhat earlier, is also victimised. H.A. (see *J.B.N.H.S.*, xxxv, 458) once found a House-Crow's nest at Bhāndūp (9 June) containing 11 Koel eggs exclusively. These belonged to two different types and were probably the product of two females. While crow and Koel *eggs* may often be found together in a nest, it is but rarely—in our experience, never—that one comes across a victimised crow's nest containing both crow and Koel *young*. Usually there is only 1—very exceptionally 2—of the latter in sole possession, from which it would appear that like the Cuckoo, the Koel hatchling also disposes of its rightful foster-brothers by heaving them out of the nest. It is surprising how thoroughly an intelligent bird like the crow will be duped into incubating the impostor's eggs and rearing its young especially when the young Koel, which is speckled and barred with white, is so unlike its own young in appearance.

We have never witnessed a Koel in the act of depositing her egg and there is some doubt as to the actual procedure. From circumstantial evidence, however, it appears that she snatches the opportunity for doing so while the male Koel draws the owners away from the nest by leading them a chase. The eggs of this cuckoo are very like the crow's in appearance—pale greyish-green or stone-colour, speckled and blotched with reddish-brown.

The Common Crow-Pheasant or Coucal : *Centropus sinensis parroti* Stres.

Local name (Mahrātti?) : *Kūmar Kaūla.*

Field identification : Size that of the Jungle-Crow. A striking glossy black bird with chestnut wings and long broad tail. Singly or pairs, in scrub jungle, mango groves, etc. Usually stalking along the ground like a pheasant searching the undergrowth for food.

Specimens : *B.N.H.S.* : ♂ 27-12-23 Andhēri (S. H. Prater) ; *St. X.C.* : 53 ♀ 20-8-33 Chendevli, Salsette (H.A.).

Noted : *Salsette* : Marōl, Pāli Hill—Bandra, Trombay Hills and Chembūr; Tūlsi Lake environs, Gōdhbunder, Thāna, Malād, etc.

Resident. Common. Its call is the familiar *ook, ook, ook,* etc. so commonly heard on the countryside especially during the hot weather. Besides this it has a large variety of croaks and chuckles—some distinctly weird—which are usually heard in the breeding season. Its food consists of caterpillars, grasshoppers, beetles, bugs and insects of every description. In addition, we have found it greedily devouring mice, frogs, geckos (*Hemidactylus*), skinks (*Mabuia*), Bloodsucker lizards (*Calotes*) and Green Whip Snakes (*Dryophis mycterizans*). It is also highly destructive to the eggs and young of other birds.

Breeding : The Crow-Pheasant is one of the respectable cuckoos that do not foist their domestic responsibilities upon other birds. Its nest is a large globular structure about a foot in diameter, of coarse grasses, strips of palm leaves, etc. placed at moderate heights in a thorny bush or tree. We have not found a nest within the limits of Salsette as yet, but the female shot on 20 August ('33) had soft ovarian eggs, indicating that the breeding season here is during the S.-W. Monsoon.

[**The Large Alexandrine Paroquet** : *Psittacula eupatria* ssp.

Hindustani name : *Hīraman tōta.*

Field identification : Size about that of the Pigeon. Slenderer and with a long pointed tail. A grass green paroquet with a black and rose-pink collar in the male (absent in female). A conspicuous maroon-red patch on the shoulder. Usually seen in fanciers' cages.

We have only observed the Large Paroquet flying overhead in small parties in various parts of Bombay City, but never in the well-wooded or hilly tracts of Salsette where one would expect to find it in the wild state. From this it would seem that all the birds here are escapes, since it is a favourite cage bird and numbers are always for sale in the Crawford Market. According to Barnes (*J.B.N.H.S.*, v, 13) these imported birds mostly come from the Central Provinces. The race therefore would be the typical one *P. e. eupatria.* It is said to be a good 'talker'. Its call is deeper and more 'sedate' than that of the Rose-ringed Paroquet.]

The Rose-ringed Paroquet : *Psittacula krameri manillensis* (Bechst.).

Local name : *Pōpat.*

Field identification : A somewhat smaller replica of the above, but lacking the red shoulder-patch. Parties, usually noisy, in mango orchards and thinly wooded country ; also in gardens and trees in the city. Occupying holes in outer brick walls of buildings and temples. Commonly caged.

Specimens : *B.N.H.S.* : ♂ 25-3-24 Warden Road, Cumbala Hill (S.A.).

Noted : *City* : Chowpāti (Wilson College neighbourhood), Fort, Elphinstone Circle, Colāba, Churchgate, Bhūlēshwar, Parēl, Byculla, etc. *Salsette* : Pāli Hill—Bandra, Andhēri, Borivli, Gōdhbunder, Powāi Lake environs, Chembūr, Bhāndūp, Thāna, etc.

Resident. Common. Destructive to ripening mangoes and fruit of every kind. Invariably present on *Bombax* and *Erythrina* flowers biting off the petals and eating the nectar. It is destructive in its methods and of no service in cross-pollination. At Dāna Bunder and the Goods sheds of the G.I.P. and B.B. & C.I. Railways, these paroquets may usually be seen clambering about and biting into the grain bags arriving from upcountry, and helping themselves to the contents.

Breeding : The Rose-ringed Paroquet breeds in suitable holes in walls of buildings and trees, both within and without city limits, not excluding the noisiest and most congested parts of the town. February, March and April are the months most favoured for nesting. In trees, woodpecker- and barbet-holes are utilised, as well as those excavated by the birds themselves. The rotten stems of Palmyra palms standing in the water at Powāi Lake and elsewhere, and cocoanut palms at Jūhū, Māhim, etc. offer suitable sites. The normal clutch is of 3 or 4 eggs, roundish oval, white, unmarked.

The Blossom-headed Paroquet : *Psittacula cyanocephala cyanocephala* (Linn.).

Field identification : Smaller than the last. About the size of the Myna; slenderer and with a long pointed tail. General colour yellowish green. The male has a beautiful bluish-red head which in the female is bluish-grey. The bright maroon-red patch on the shoulder of the male is absent or obsolete in the female. In flight the peculiar sharp single interrogative cry *tooi?* and the yellow tip of the tail are diagnostic features. Small flocks in wooded country, Jāmūn groves, etc.

Specimens : *B.N.H.S.* : oo? 2-12-25 Kūrla (Baretto).

Noted : *Salsette* : Pāli Hill—Bandra (M. Suter!), Andhēri, Chembūr, Borivli, Tūlsi Lake, Powāi. Not in city limits.

Status uncertain. Our records here are only between 7 August and 31 March, but we have noted a flock at Kihim (across the harbour) on 11 June. It is possibly largely a dry season visitor from the Ghāts and Deccan.

The Loriquet : *Coryllis vernalis* ssp.

Field identification : Size about that of the House-Sparrow. A bright yellowish-green little parrot with a red bill, short square tail and a crimson rump. Singly or small parties, among leafy trees in wooded country.

No specimens.

Status uncertain. Not uncommon, but patchily distributed and to some extent undoubtedly also a local migrant. We have no record of it in Salsette between 23 June and 9 September. On the other hand, at Kihim (Alibāg Talūka) *ca.* 15 miles from Bombay City, across the harbour, they appeared to arrive in the first week of June (1930) and were very common throughout the monsoon, disappearing completely by the beginning of November! These little birds on account of their small size and wonderfully obliterative colouration are usually visible only when flying across from one tree to another. The flight is swift, consisting of several rapid wing-strokes followed by a short pause and a consequent slight dip. It is invariably accompanied by a sharp trisyllabic *chee-chee-chee,* repeated every couple of seconds or so. Their food consists of *Ficus* figs and other fruits and berries. The nectar of flowers, especially *Erythrina,* is also largely eaten.

We have no record of its breeding in Salsette or on the adjacent mainland.

The Indian Roller : *Coracias benghalensis indica* Linn.

Field identification : Size of the Pigeon. A striking Oxford-and-Cambridge-blue bird with biggish head, heavy bill, rufous-brown breast and blue abdomen and undertail. Singly, perched on telegraph wires or in some other exposed situation such as a fencepost or a tree-stump, in open fallow land and cultivation. Laboured flight with deliberate wing beats.

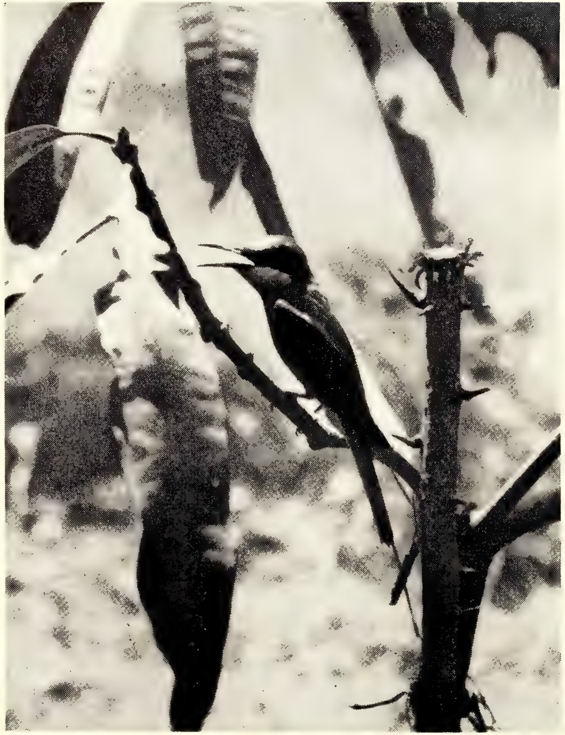
Specimens : *B.N.H.S.* : ♂ 21-2-21 Santa Cruz (B. C. Ellison); *St. X. C.* : 168 ♂ 19-11-33 Andhēri (H.A.).

Noted : *City* : Churchgate Reclamation. *Salsette* : Matūnga, Kūrla, Chembūr Trombay, Mulund, Borivli, etc.

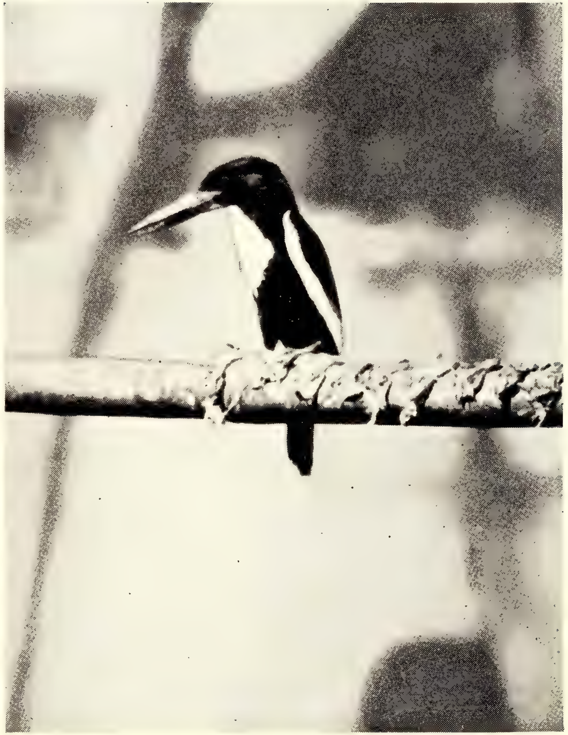
Resident? Not common. Its food consists of grasshoppers, crickets and other insects usually captured on the ground. When an insect is sighted the bird flies down to it and returns to the same perch or another one nearby, where the victim is battered and swallowed. It has a variety of loud raucous calls and is particularly noisy and demonstrative in the breeding season when the male also indulges in some fantastic aerobatics.

We have no information regarding its breeding in Salsette, but we have once observed the above nuptial display (Borivli) in March which suggests the probability.

According to Aitken (*J.B.N.H.S.*, xiii, 398) the European Roller (*Coracias garrula* ssp.), distinguished from our bird in having the underparts pale blue throughout, has occurred in or near Bombay. H.A. observed this bird at Khandāla in the Western Ghāts on 25-3-34, and obtained two specimens of the Kashmir race (*C. g. semenowi*) in October-November 1935.



The Common Indian Bee-eater (*Merops orientalis orientalis*, Latham).



The White-breasted Kingfisher [*Halcyon smyrnensis smyrnensis* (Linn.)].

Photos by ***Sálim Ali.***

[**The Common Indian Bee-eater** : *Merops orientalis orientalis* Latham.

Mahrātti name : *Patēri.*

Field identification : Size about that of the House-Sparrow. A bright green bird tinged with reddish-brown on the head and neck. Two pointed feathers sticking out beyond the tail. A narrow black gorget on foreneck. Slender, long, slightly curved bill. Parties, in gardens, open country and near the seashore. Perching on telegraph wires, fence-posts, etc., making graceful sallies and swoops after winged insects, capturing them in mid-air and circling round on motionless wings back to the perch. Often dust-bathing on country roads.

Specimens : *B.N.H.S.* : ♂ 29-12-23 Andhēri (S. H. Prater); *St. X. C.* : 41 ♀ 6-8-33 Marōl (H.A.).

Noted : *City* : Malabār and Cumbāla Hills, Wālkēshwar, Mahāluxmi, Victoria Gardens—Byculla, etc. *Salsette* : Pāli Hill, Khār, Jūhū, Versōva, Chembūr Trombay, Borivli, Kandivli, Gōdhbunder, Thāna and elsewhere generally.

Resident and local migrant. Though very common during the dry months, the great majority of Bee-eaters disappear from Bombay and Salsette about the middle of April. During the rainy season, i.e. up to about the end of August, they are only rarely seen.

The birds roost at night in leafy trees into which they begin to collect about sunset. Great noise and bustle prevails, the gathering suddenly flying out in a rabble every now and again and returning after circling about in disorder above the tree. They are late risers, and parties may be seen sleeping huddled together on a branch well after the sun is up.

Breeding : We have no record of nests in Bombay or Salsette, but the birds breed freely at and in the neighbourhood of Alibāg across the harbour. The nest is at the end of a curved tunnel in sandy soil or soft earth. The burrow is either driven horizontally into a bank or cutting or sunk obliquely into more or less level ground. It is usually from 1 to 3 feet deep and about 1½ inches in diameter. Four to six roundish white eggs form the normal clutch. They seem to be laid at longer intervals than 24 hours each, and incubation commences—or perhaps the heat in the tunnel suffices for the purpose?—from the first egg. This is evident from the great disparity between the growth of the oldest and youngest chick in a nest.]

[**The Blue-tailed Bee-eater** : *Merops superciliosus javanicus* Horsf.

Field identification : Somewhat larger than the Common Bee-eater—about the size of the Bulbul—but generally similar to it in appearance. Bright bluish-green with a greenish-blue tail including the pin feathers. A black stripe through the eye.

Specimen : *B.N.H.S.* : o? 19-9-26 Kandivli (S.A.).

Noted : *Salsette* : Santa Cruz, Sāki, Andhēri, Borivli, Thāna. *Mainland*, Kihim, Kolāba District (specimen ♂ 17-10-26).

A passage migrant (to the south?) in September-October. All our records are during these 2 months only. Once (28 April) a bird was heard passing over at Santa Cruz, probably on return passage, but it is evident that for this they follow some other route and the majority at least avoid Salsette. These bee-eaters keep to open country and we have frequently observed parties on the sandy seashore. Its notes are like the Common Bee-eater's, but deeper and readily distinguishable from them.]

[**The Blue-cheeked Bee-eater** : *Merops superciliosus persicus* Pallas.

This race presumably also passes over Salsette in October. We have no specimen from actually within our limits, but a male obtained by H.A. at Bassein (Thāna District) on 13 October ('33) belongs to it. On that date he found the birds to be very abundant there, all perching more or less exclusively on the telegraph wires whence they launched sallies after winged insects. This subspecies differs from *javanicus* chiefly in having the rump and tail more green less blue, and in possessing more conspicuous blue-green cheeks.]

The Pied Kingfisher : *Ceryle rudis leucomelanura* Reichenbach.

Field identification : Size about that of the Myna. A speckled and barred black and white bird with a stout, dagger-shaped bill. Singly or pairs, by streams and tanks, hovering ('standing on its tail') in mid-air and dropping like a bolt upon fishes near the surface.

No specimens.

Noted: *Salsette*: Powāi Lake, Māhim. Across the harbour at Māndwā, Kihim, Alibāg, etc.

Resident? Uncommon. It is usually found by fresh water, but we have frequently observed it fishing on tidal creeks and in salt water pools on the rocky seashore. It utters a sharp *chirruk, chirruk* as it flies.

We are not aware of its nesting in our area or its immediate neighbourhood.

The Common Indian Kingfisher: *Alcedo atthis bengalensis* Gmelin.

Field identification: Size about that of the House-Sparrow, with a short stumpy tail and a long, straight, pointed bill. An attractive blue and green little bird with deep rust-coloured underparts. Singly, by water—stream, tank, puddle or sometimes even a well. Usually seen perched on a bush or rock overhanging water, or in swift direct flight above the surface, uttering a squeaky *chi-chi-chi*. When sitting, bolt upright as is its wont, it bobs its head up and down, turns it from side to side, jerks its stump of a tail and utters little subdued *clicks* from time to time.

Specimens: *B.N.H.S.*: ♀ 16-1-24 Andhēri (S. H. Prater). *St. X. C.*: 38 ♀ juv. 29-7-33 Gōrēgāon (H.A.).

Noted: *City*: Dhōbi Talāo (1913), Scandal Point—Mahāluxmi. *Salsette*: Pāli Hill, Dānda, Bhāyndar, Chembūr, Borivli, Powāi-Tūlsi-Vihār Lakes, etc.

Resident. Common. Its method of fishing differs from that of the Pied Kingfisher in that it seldom hovers. More usually it drops upon the victim from an overhanging perch and returns with it to the same or a nearby one to batter and swallow it.

Breeding: We have found nests in Salsette with eggs or young at Wadaūli (Chembūr), Sāki, Borivli, and Andhēri between the middle of July and the end of August. By the latter date, most eggs have hatched. The nest or egg-chamber is at the end of a tunnel dug into the side of an earth-cutting, 1 to 3 feet deep. A normal clutch consists of from 4 to 7 eggs, roundish, white, unmarked.

The Indian three-toed Kingfisher: *Ceyx erithaca erithaca* (Linn.).

Field identification: Slightly smaller than the Common Kingfisher. A lovely little orange-brown, lilac and blue bird with rusty orange-yellow underparts. A deep blue patch on either side of neck and a rufous patch on the underwing conspicuous—the latter only in flight. Singly, by streams, pools and rain puddles in forest.

Specimens: *B.N.H.S.*: o? 18-6-02 Government Dockyard, Bombay (Mrs. A. J. Paterson); o? 3-10-10 Bombay City (?); o? 12-9-24 Pāli Hill, Bandra (Mrs. Wright).

Noted: *Salsette*: Gōdhbunder, Deonar-Chembūr, Trombay Hills, Powāi.

Monsoon visitor. The specimens as well as all our sight records cover the months June to October only, i.e. the S.-W. Monsoon season. We have no evidence that the bird is with us during the rest of the year.

The White-breasted Kingfisher: *Halcyon smyrnensis smyrnensis* (Linn.).

Local name: *Chingla.*

Field identification: Size of the Myna, slightly bigger. Brilliant turquoise blue above, dark chocolate-brown head neck and underparts. A conspicuous white 'shirt front'. Long, stout, pointed, straight red bill. Singly, on tree stumps, telegraph poles, fence posts, etc. in open thin forest, near tanks, wells, puddles, at fish-yards, etc.—also away from water.

Specimen: *B.N.H.S.*: ♂ 18-10-24, o? 13-2-26 Kūrla (D. A. Baretto).

Noted: *City*: Dhōbi Talāo (1913), Byculla, Chowpāti, Warden Road, Malabār Hill, Wālkēshwar. Generally in Salsette.

Resident. Common. Its diet is not confined to fish. Earthworms, insects, frogs, lizards, mice and young birds are all relished. Its call or 'song' is a loud, not unmusical, chattering scream uttered from the top of a tree or some other exposed situation. It ends in a detached, harsh undertone, something like the *pench* of a snipe, audible only at close quarters.

Breeding: The principal breeding months in our area are May, June and July. The nest tunnel, as with the other kingfishers, is dug into the side of an earth cutting or bank 2 to 3 feet deep and ends in a circular egg-chamber about 6 inches in diameter. A normal full clutch consists of 5 or 6 eggs, more often the former. They are pure white, roundish ovals. H.A. has observed that the nestlings, when pulled out of the nest, back away into the tunnel on their 'hocks'. If replaced in the tunnel head first they invariably back out of it, but if inserted head facing outwards the young will slowly back into the nest! The nestlings seem incapable of forward movement at this early stage. Inglis (*J.B.N.H.S.*, xi, 480) also says that the young of the Common Bee-eater have a curious habit of 'walking backwards when being fed by the hand'. It is significant that both these species are tunnel breeders, and this habit is doubtless of survival value to their chicks.

The Black-capped Kingfisher : *Halcyon pileata* (Bodd.).

Field identification : Size same as that of the White-breasted species. Rich cobalt blue above, buffy-white with rufous tinge below. Top of head or 'cap' velvety black. A prominent white collar round the hindneck. Bright coral red bill. Singly, by tidal creeks and mangroves about the sea-coast.

Specimens : *B.N.H.S.* : o? 31-10-08 Kolsette Bunder, Thāna Creek (L. H. Saville); o? 11-11-28 Gōdhbunder (S.A.); *St. X. C.* : o? 28-11-? Gōdhbunder (H.A.).

Noted : *City* : Chowpāti (once—flying over, 7-10-26) *Salsette* : Tūlsi Lake (January), Andhēri (January and February).

Presumably, as suggested by Aitken (*J.B.N.H.S.*, xi, 164), a cold weather visitor to Salsette. All the specimens and our sight records are between October and February. We have also met with it in the Rewa Dānda Creek Kolāba District in January; there is a specimen thence in the Society's Collection dated 13 December, and another one from Kalyān also shot in December. E. H. Aitken often saw it in the vicinity of the seashore and creeks along the Konkan Coast, perched on high trees whence it swooped down with the action of a hawk upon the sand crabs which he believed formed its chief food.

The Great Indian Hornbill : *Dichoceros bicornis* (Linn.).

EHA in the introduction to his *Common Birds of Bombay* writes : '. . . . a misguided hornbill may make its appearance on Malabar Hill'. We do not know of one ever having done so, within recent years at any rate, and it is therefore surprising to read the distribution of the Great Hornbill (new *Fauna*, iv, 284) in South India as 'along the western coast from S. Travancore to Bombay City . . . .'

The Malabar Grey Hornbill : *Tockus griseus* (Latham).

H.A. saw a single hornbill of this species at Gōdhbunder on 17-4-34. It was being chivvied by a pair of Jungle Crows. It took refuge in a tree but was hustled out and chased out of sight. This is the only record we have of the occurrence of any hornbill in Salsette.

The Hoopoe : *Upupa epops* ssp.

Field identification : Size about that of the Myna. A rufous-brown full-crested bird with black and white zebra-like markings on the back and wings. a long slender slightly curved bill and short legs. Singly or pairs, in open scrub country, light jungle or near villages, running about on the ground like quail but with a somewhat waddling gait, and digging with its bill. The crest is erected and opened out fanwise when the bird alights after a short flight.

Specimens : *B.N.H.S.* : ♂ 3-1-24, ♀ 18-1-24 Andhēri (S. H. Prater); o? 13-12-08 Andhēri (Kinnear).

Noted : *Salsette* : Pāli Hill, Khār, Chembūr.

Presumably a winter visitor only. We have no record of it in Salsette between 21 March and 12 October. Apparently both the races *orientalis* and *ceylonensis* occur within our limits. While with us, the Hoopoe is mostly silent.

It breeds on the Western Ghāts and in the Deccan. Brother Navarro of St. Xavier's College had a young bird brought to him at Khandāla (2,000 ft.) in May (race *ceylonensis*?).

The Malabar Trogon : *Harpactes fasciatus malabaricus* (Gould).

Field identification : Size about that of a dove. Head, neck and breast grey. A white collar dividing the last from the striking crimson lower plumage. Upper parts (back etc.) yellowish-brown. Fine wavy white bars in the wing. Bill and bare skin round the eye blue. Female duller with the underparts orange-brown instead of crimson. Pairs or small parties, in heavy deciduous jungle.

Specimens : *St. X. C.* : 194 ♂ 31-12-34 Hills N.E. of Borivli (H.A.).

Noted. *Salsette* : Tūlsi Lake environs. *Adjacent mainland* : Tūngār Hill, Bassein, Thāna District.

Evidently a local cold weather immigrant to Salsette. Rare. We have come across it here only on three occasions : 24 November, 30 December and 3 March. The party keeps up a subdued musical chuckle. When the specimen was shot, the female kept uttering a low *krr* in the neighbourhood.

[**The Alpine Swift** : *Micropus melba* ssp.

EHA (*C.B.B.*, p. 41) says he shot this bird 'a few miles from Bombay' (in Salsette?). We have not come across it in our area.]

The Common Indian House-Swift : *Micropus affinis affinis* (Gray).

Field identification : Smaller than the House-Sparrow, but with longer and narrower wings. Smoky-black with white throat and white rump. Short square tail. In overhead flight the backwardly curving narrow wings look like a bow and the body an arrow set in it. Gregariously, hawkinng insects on the wing, near human habitations, open country, above tidal mudflats, etc.

Specimens : *B.N.H.S.* : o? 8-4-24 Mudflats—Sion Causeway (S.A.); ♂ -10-15 Bombay (S. H. Prater); ♂ 2-10-25 Bombay (C. McCann); ♀ 18-9-12 Cumbāla Hill; *St. X. C.* : 66 ♀ 5-9-33 Andhēri (H.A.).

Noted : *City* : Bhūlēshwar, Fort, Chowpāti. *Salsette* : Borivli, Mulund, Thāna, Ghātkōpar.

Resident. Common. Large numbers occasionally seen about sunset hawking winged insects or 'balling high up in the air with shrill cries.

Breeding : The House-Swift usually builds in colonies, but single nests or just 2 or 3 together are not uncommon. They are, as a rule, plastered helter-skelter along the angle of the wall and ceiling in buildings and porches, both deserted and occupied, in the midst of the busiest part of the town or outside. They are round untidy cups made entirely of feathers, grass, etc. cemented together by the birds' saliva. The entrance-hole is often merely a slit between the wall and the nest. The birds use the nests throughout the year for roosting purposes as well, and so it is difficult to say without examination exactly when they are breeding and when not. H.A. has taken 2 fresh eggs at Andhēri on 27 March and found a nestling in the same nest on 10 April of the following year. The same site and nests—repaired if necessary—are used for many years in succession if the birds are left undisturbed. The colony of nests under the entrance archway of Messrs. Greaves Cotton & Co. Forbes Street, Fort, mentioned by EHA (*C.B.B.*, p. 40) in 1880 or thereabouts, is in occupation to this day!

Usually 2 eggs are laid. They are long ovals and pure white in colour.

The Palm Swift : *Cypsiurus batasiensis palmarum* (Gray).

Mahrātti name : *Shimri.*

Field identification : Smaller than the House-Sparrow; considerably slenderer in body with long slender wings. Uniform smoky-brown in colour. Invariably seen on the wing, hawking flying insects in open country. Inseparable from Palmyra palms. The deep cleft or fork in the tail is noticeable when the bird wheels in flight.

Specimens : *B.N.H.S.* : o? 16-2-24 Pāli Hill, Bandra (S.A.); *St. X. C.* : 48 ♂ 17-7-33 Andhēri (H.A.).

Noted : *City* : Malabār Hill, Tārdeo, Cumbāla Hill, Byculla, Parēl. Common everywhere in suburbs and Salsette.

Resident. Common. It has a shrill, joyous quick repeated triple note *ti-ti-tee* uttered on the wing. H.A. observed a pure albino, except for the wings, flying about amongst *Borassus* palms along with normally coloured birds (Powāi, 3-6-36).

Breeding: We have records of the following nests in Salsette:

15 April ('34—Andhēri) 1 nearly full-fledged chick (H.A.).
6 August ('35—Tārdeo, Bombay) eggs (Br. Navarro),
20 August ('35—Cumbāla Hill, Bombay) *A* 1 fresh egg; *B* bird brooding,
2nd week September ,, 1 hardset egg.

The nest is a tiny half-saucer, or shallow purse, made of vegetable down and feathers agglutinated with the bird's saliva and cemented into a furrow on the underside of a Palmyra leaf. It measures about 2 inches from side to side. The normal clutch is of 2 eggs—long, pointed ovals and white in colour.

Hume's Nightjar : *Caprimulgus europaeus unwini* Hume.

Specimen : *B.N.H.S.* : ♀ October 1915 Colāba, Bombay City.

An aberrant straggler? This specimen was caught by Mr. Prater in his room wherein it appears to have blundered.

[**Sykes's Nightjar**: *Caprimulgus mahrattensis* Sykes.

Specimens : *B.N.H.S.* : ♀ 7-12-99 Kalyān (J. Brand).

We have not come across this species in Salsette. The specimen was also most probably an aberrant straggler, but it is worth including in this list in view of the nearness of Kalyān (on the mainland, across Thāna Creek) to our area.]

The Common Indian Nightjar : *Caprimulgus asiaticus* Latham.

Field identification : Size about that of the Myna. Yellowish-grey and pale brown above with black streaks in a complicated camouflaging pattern. Buff and fulvous underneath. White patches on wing conspicuous when flying. Large owl-like head with large eyes and wide gape. Singly, in scrub in compounds, ravines or thin jungle. Lying close on ground invisible amongst dry leaves and rising up when almost trampled upon. Silent, rather leisurely flight. Often seen on suburban roads at dusk, eyes gleaming red in the headlights of an on-coming car.

Specimens : *B.N.H.S.* : ♀ 20-11-99 Bombay, ♂ 20-5-31 Malād; *St. X. C.* : 246 o? 12-12-35 Andhēri (H.A.).

Noted : *Salsette* : Santa Cruz, Vilé Parlé, Chembūr, Gōdhbunder-Thāna Road.

Winter visitor? Our records in Salsette are all between October and May (latest 20th). It is fairly common during December. A low *chūk-chūk* uttered on the wing, is the only call we have heard while the birds are with us. The stomachs of two specimens shot at Andhēri contained the following: 13 Dung Beetles (*Onthophaga* sp.), 1 Disticid Beetle, 1 cricket (*Gryllus* sp.).

It is noteworthy that several of the Dung Beetles were still alive when removed from the birds' stomachs 18 hours after they were shot!

(*To be continued*).

THE ORIGINAL HOME OF THE COCONUT.

BY

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The origin of most cultivated plants is enshrouded in mystery and few among them have received as much attention at the hands of eminent botanists as the Coconut. Dr. H. N. Ridley, Sir Arthur Hill, Dr. E. D. Merril and others have all made very valuable contributions to our knowledge of the original home and spread of this most useful of palms, pantropic into cultivation. The present paper, while examining most of what has already been said discusses the problem from the standpoint of the antiquity of the Coconut in India and attempts to locate its native home more definitely by taking into consideration the geological history of the regions under discussion. It also supplements botanical and biological evidences with philological and ethnological issues.

That the Coconut has been known in India from the earliest of times is an unquestionable fact. Mention is made of it in several of the Puranas which are the oldest books after the Vedas. The Maha Bhagavata, Vishnu, Matsya, Markandeya and Brahmanda Puranas have references to the Coconut. There is also mention of it in the Ramayana and the Maha Bharata and also in ancient Tamil literature like Porunarattupadai. The above references prove the great antiquity of the Coconut in India but do not show that it is native to the country. Although now an inevitable article used in worship throughout Peninsular India it is significant that the coconut is not included among the fourteen articles sanctioned by the Shastras in the performance of holy sacrifices. Nor is it used by a considerable section of the orthodox Hindus in sradha ceremonies—those performed to propitiate the *manes* of the departed—in which non-indigenous vegetables are tabooed. Again, though an indispensable item in sacrifices offered to Ganapati, it is not in the list of articles favourite with that deity as prescribed in the Dharma Shastras. In all auspicious ceremonies of the Hindus, worship is offered to Varuna, the deity presiding over the water and the oceans. This deity is represented by a pot of water with a coconut placed on its mouth. A text is repeated in praise of the Coconut which says that it is a favourite with God Shiva and a destroyer of inauspiciousness. This text has come from a very remote period but is not Vedic. Such of the observances as are not in the Vedas are traceable to the Tantras which are of a much later origin. The offering of an unbroken coconut to the sea by orthodox Hindus on auspicious occasions is probably suggestive of the idea that the Coconut came from the seas. And there is a Ceylonese legend which says that it was brought to India from Nagaloka, the blissful region beneath the seas, by an illustrious king for special worship and was thence introduced into Ceylon by a king of that island for a similar purpose.

The Sanscrit name for the coconut is *Nalikera* or *Narikela* the *r* and the *l* being interchangeable according to the rules of Sanscrit grammar. Paucity of names in a language replete with synonymy is indicative of foreign nativity. In Pali also, it is known as *Nalikera.* North Indian languages as well as Arabic and Persian have their names for the coconut derived from Sanscrit. The philological relation of the Malayan names *Kerambil* and *Kelambir* with the Sanscrit is worth investigating. My view is that they have come from the Sanscrit as a result of Hindu influence. In the early centuries of the Christian era the Hindus had conquered and colonized a great part of Malaya and the Malayan Archipelago, and it is natural to assume that the names used by the conquering race were adopted by the sons of the soil with some local variations and that these names have persisted through centuries side by side with the native names. In Sanscrit literature, we come across the word *Kera* in place of *Nalikera* as in *Kera bala phala* which means the fruit of a young coconut tree. The transition from *Kera* to *Kerambil* is recognisable. Further, it may be observed that these names, again with their variants, are used in Sumatra, Java and the smaller adjacent islands. *Kelapa, Kelapo* and *Kalapa* are names for the coconut in Java; in the Malay Peninsula it is *Klapa.* I am of opinion that these names also are after the Sanscrit form *Kela* or *Kela phala,* the fruit. It is significant to note that this series and the one just previously discussed are in use only in the lands once under Hindu colonization. Further, the investigations of Dr. Bartlett[1] help to remove any possible doubts as to whether the Malayan names could have influenced the Sanscritic. He has concluded that the Niu-Niog series is the oldest, that the Kerambil series came into use much later, and that the Kelapa series is the most recent of all. The Sinhalese name *Pōl* has probably originated from the Sanscrit *Phala* which means a fruit, as the coconut is described as the *Purna phala* which means the perfect fruit. Nirali, the name used in ancient Sinhalese works, also comes from Sanscrit. The commercial name *copra* by which the dried kernel is known all over the world has likewise a Sanscritic origin. *Karpara* in Sanscrit means a skull or cranium and there is an etiological story extant in South India which says that the Coconut was created in lieu of a head. Thus *Karpara* has come to mean a coconut among the common people, from the resemblance of the shell to the human skull. In Prakrit which is the colloquial form of Sanscrit the *r* is always elided and hence *Karpara* becomes *Kappara.* From *Kappara* has come the Malayalam *Koppara* the *a* having changed to *o,* just as Sanscrit *Ghata* became *Kota* in Malayalam. *Koppara* has become *Kopra* or Copra, and has gained a place in standard English dictionaries.

The Tamil name for the coconut is *Tengu, Ten* or *Tennai.* It is mere speculation to seek to explain the root meaning of these words. *Kāi* is the name for a fruit. According to the rules of Tamil grammar *Tengu-Kāi* becomes *Tēnkāi* which is the name by which the fruit is known throughout the Tamil country. That the Tamils knew the coconut earlier than any other section of people in South India is evidenced by the fact that other languages of South India have derived their names for it from Tamil. The Malayalam *Tengu* and *Tēnga*, the Telugu *Tenkāya* and the Kanarese *Tengu* and *Tengina Kāyi* have all originated from Tamil. The Sinhalese name for a dry waterless coconut, *Kotta pōl,* and that for an immature fruit—*Kurumba,* must have come from the Tamil *Kotta Tēnkai* and *Kurumai* respectively. The Tamils were an enterprising race who had attained maritime importance in ancient ages and had crossed the seas to trade with distant islands of the Eastern Archipelago. Traces of their age-long civilization are discernible in the islands they had conquered in the distant past. Possibly they brought back several varieties of coconut to South India.

From Marquesas Island to Madagascar the coconut is known by one or more variants of the name, *Niyu* which has multiplied into local forms like *Nia, Nio, Niog, Nijol* and a host of derivatives too numerous to mention, testifying that the name has travelled with the plant itself. Of these some like *Noera, Njor, Noora, Noro, Nor,* extant in the Malay Archipelago, are of some interest. Whether these latter names have any relation with the Sanscrit *Narikela* is again a problem for the comparative philologist. My impression is that the latter series are derivatives from the Sanscrit *Nari-kela.* It is interesting to note that the name *Nore,* which obviously belongs to the latter series, in the jargon of some of the backward classes of the Malabar Coast means the fresh kernel of a coconut. A list of all the recorded oriental names for the coconut would run through several pages. Heyne[2] records 180 names from the Netherlands East Indies alone. It is apparent that philologists have not so far paid any attention to the wealth of material available and the value of contributions based on its study should not be underrated.

The original home of the Coconut should be a region where the nuts would freely germinate without watering, where its cultivation would demand the least care, where the plant could provide for itself, and where it would grow very prolifically as is the case in Malaya, the Eastern Archipelago, or the islands of the West and Central Pacific Ocean in the equatorial belt where coconuts grow as densely as bristles in a brush. These are regions of heavy and constant rainfall with a warm moist climate. That it is a sea-side plant is evidenced by its high tolerance for saline moisture, by its nuts being adapted to efficient dispersal by sea and by the rare attribute of vivipary. The original form of the Coconut must have been one with viviparous adaptations and the inland form of today should be a retrograde from the original. Coastal swamps which are the home of the mangroves provide a habitat in which the Coconut cannot grow. A sea-washed well-drained coast with constant fresh moving water in the soil is genial to the palm. A region of light wind is more conducive to its growth than a region of violent winds. The area of equatorial calms characterized by light and varied winds, heavy and constant rainfall, extreme humidity, equable climate, and warmth without heat, provides ideal conditions for the nurture and growth of the Coconut. This then is the region where its place of origin should lie.

Cocos is an American genus; with the exception of the Coconut there is no living representative of that genus anywhere except in the Continent of America. This had led many a botanist into presuming that America was the original home of the Coconut. But the discovery of fossil *Cocos*[3] in the Pliocene deposits of North Auckland in New Zealand proves that the genus *Cocos* in bye-gone ages had a far wider distribution than it has today. The Spanish traveller Oviedo[4] found a large grove of coconuts on the shores of the Isthmus of Panama in 1515. Thus the Coconut was already established on the west coast of Central America when Europeans first landed there. Oviedo's discovery lent support to the view that the Coconut was evolved in America. But the west coast lands of America are dry and it is not at all likely that a species with so strong a predilection to a moist climate and heavy rainfall should have originated in the dry zone of Central America in preference to the moist eastern zone which is better suited to its growth. Actually the Coconut was unknown on the east coast of America until the Spaniards introduced it. This argument, however, involves a supposition that the west coast and the isthmian region of Central America always had a generally dry climate despite any climatic pulsations through the distant past. The grove of coconuts seen by Oviedo may have originated from nuts carried thither by Polynesian immigrants. The soil there was a fine loam well drained by the tides for a considerable distance without stagnating. There was adequate rainfall and sufficient protection against violent winds. Under such surroundings the Coconut could easily establish itself. When we attempt to trace the home of any species the place of its original discovery may mean nothing or very little. It is the whole area of dispersal that counts. Peter Martyn,[5] who in the year 1520 explored the East Indies, wrote that in the island of Moluchas (Moluccas) he saw the Coconut (Coccus) growing 'quite accidentally'. His statement is of value in settling the issues. Further, the fact that at the time of their discovery, when they were uninhabited, the Cocos Keeling Islands of the Indian Ocean were wooded with coconut trees, evidently started from ocean-borne nuts, has also to be taken into account. There are yet other islands of the Indian Ocean which stand as outposts of oceanic flora to which the coconut has extended its range naturally and bear testimonies of their own. That one fails to notice the use of the coconut among the aborigines of Central America, when it forms an integral part of the ceremonials, culture and technology of the islanders of the Pacific and Indian Oceans and even more the lack of native American names for the coconut are sufficient proofs that it is not of American origin. And conceding for a moment that it started from America one asks how it reached India millenniums ago when it is an established fact that the American aborigines had neither the incentive, nor the need, nor the skill to journey beyond the vicinity of their native shores.

The Polynesian islands and the numerous small islands of the

Western Pacific are all either of coralline or volcanic formation and as such represent geologically new lands. Hence the first plant colonists of these islands should have reached thither by the agency of air or water. The Coconut could not therefore have evolved on those islands though most of them are admirably adapted for its growth. Though established in other lands it is in Polynesia that the Coconut has attained its highest development. It is here that its many varieties were perfected as insular climates always favour endemism. Storm-swept islands of small size should give rise to several dwarf forms and Brown[6] enumerates over fifty varieties of coconuts in Marquesas Island, where every variety is known under a distinct native binomial. Incidentally it may be mentioned that not more than two or three varieties are known from America. The Polynesians must have known the Coconut ever since their islands came to be inhabited and a coconut civilization such as theirs should be as old as their race. With them the Coconut has always occupied a high ceremonial status, being worshipped as one of their Gods, the only other botanical God, though occupying a lesser status being the Taro, *Colocasia antiquorum.* The cult of the Coconut is so ingrained in the daily life of the Polynesians that they like the Malays have definite names for the nut pertaining to various stages of its growth. According to Te Rangi Hiora,[7] the Polynesian ethnologist, thirteen names distinguish the stages of the coconut from the female flower to the dried seed nut.

De Candolle[8] in 1883 expressed the view that the Coconut most probably belongs to the Indian Archipelago; and his opinions have seldom been challenged. O. F. Cook[9] accepting the infallibility of the present classification of the genus *Cocos* put forth a strong plea in favour of its American origin and among the adherents to his theory were leading botanists. Beccari[10] cut the Gordian knot by splitting the existing genus into several genera and reducing *Cocos,* sensu stricto, to a monotypic genus with a single species, *Cocos nucifera,* the Coconut. The writer of this paper who has been engaged on this problem for several years could not find a way out of the difficulty till the discovery of fossil *Cocos* nuts from New Zealand was announced. Dr. Merril[11] writing in 1937 says that the actual place of origin of this palm is somewhat of a mystery although it is indubitably native to some part of the Old World Tropics. Prof. Emilio Chiovenda[12] in an Italian publication has interpreted certain references in the works of Arabian historians like Ibn Wahab, *fide* Abu Zaid, and Albiruni to indicate that the original home of the Coconut is not far from India. He says that it had its origin somewhere in the 'lands now under the sea which existed in the western parts of the Indian Ocean'. It is not altogether safe to base conclusions on the works of historians when we have to go back millenniums anterior to the dawn of any history when the configuration of land and sea was altogether different from what we see on a modern map. It is a happy state of things when conclusions drawn from historical data are in agreement with those based on biological grounds. However, all are agreed that the home of the coconut is somewhere between

Zanzibar and New Caledonia. No one ever thinks that Africa was its home. And all know that the Dutch East Indies, the islands of the Western Pacific and British Malaya are the great centres of coconut cultivation.

The claim of Malaysia comes in next for consideration. The geological history of this great equatorial group of islands, which extends from Northern Sumatra to Eastern New Guinea, a distance of about 4,000 miles, as discussed by Dr. Mollengraff, the eminent Dutch geologist, has been accepted by biologists and adopted by Dr. Merril[13] in his paper on the phytogeography of this region. According to these authors Malaysia is divided into two continental areas and an intermediate insular group the several islands of which are surrounded by deep straits and seas. The continental areas are the Asiatic bank—which includes the Malay Peninsula, Sumatra, Java, Bali, Borneo and the Palawan-Calamian group of the Philippines and the Australian bank which includes the ancient continent of Papua. These areas are the two great centres of origin and dispersal of plant and animal life. The intermediate and unstable area between the continental banks consisting of the Lesser Sunda Islands, the Moluccas, Gilolo, Celebes and all the Philippines except the Palawan-Calamian group, has been subject to great upheavals and depression from the earliest times. Its flora and fauna are made up partly of infiltrations from the two continental areas and partly of relic species and their descendants. Judging from its geologic history the Coconut could not have evolved in this intermediate area. The flora and fauna of the Asiatic bank is Asiatic or Malay-Asiatic in character. The Coconut having no affinities with the Asiatic genera of palms could not have evolved in the Asiatic bank.

The ancient Papuan land includes the island continent of New Guinea as we know it today and parts of it that have since been submerged. Biological evidence goes to prove that there were older lands connected with New Guinea that are now entirely submerged. It is submitted on grounds heretofore covered that the home of the Coconut should lie here. The nature of the sea shelf on the north-west of New Guinea in the region now occupied by the Geelvink Bay, of the area just to the north of it, and the level of the adjoining shore tell us that in past ages, this huge land mass extended farther in this direction than the present day map indicates. Alfred Wegener[14] and others are of opinion that the climate of the whole of Malaysia, at any rate, of the regions of low altitude, has been constant through ages. As shown by the modern map the northern fringe of the submerged platform referred to lies in the equatorial belt and before it was deluged by the ocean possibly was the cradle of the Coconut. Our present knowledge of the New Guinean flora is scanty. A greater part of its mountainous interior which rises to a height of 16,000 ft. has not been trodden by civilized man. A little known pygmy race inhabits its inaccessible recesses. Exploration of its flora has just begun and until we know what it contains we cannot draw conclusions. But from what we know of its floristics we understand that its affinities are with the Australian-New Zealand-

New Caledonian cycle. And we know that fossil *Cocos* has been discovered in New Zealand. When palæobotanical explorations are taken up in New Guinea we may expect to find fossil species of *Cocos* with closer affinities to the Coconut than its living or extinct congeners in Tropical America or New Zealand. The claim of New Caledonia, if any, is set aside on climatic grounds as it lies far too remotely from the equator, near to the tropic of Capricorn.

The Papuans of New Guinea take pride in calling themselves the coconut people and hate the non-Papuans of their island who, they say, are not of the coconut people. A very fantastic legend[15] is current among them regarding the origin of the Coconut. Incidentally it also throws light on the abominable practice of head hunting which according to these savages is an act of religious merit. Even before the creation of Man their God killed another God, Somoali by name, who later became the god of the bushmen and the nomads. He placed the head of his victim on the bank of the river Wamaga. After sleeping six nights he returned to see the head of his enemy and found leaves sprouting from it. He then planted the sprouting head in the earth and from it grew the first coconut. The mortal feud between the two gods—if the two can go by that name—has been continued by their respective followers. The Papuans who are *orang laut*—people of the sea—take the heads of bushmen—who are *orang hutan*—people of the forest—and who are followers of Somoali to please their god. Mythical as this story is, it tells us in the words of the aborigines that the Coconut was created in the land of the Papuans and that its creation is prior to that of Man.

It would appear that the Coconut having evolved on the submerged land to the north-west of New Guinea move eastwards and westwards as drift nuts over calm tropical waters, and spread from islet to islet. This mode of accidental transportation, however, could not have successfully carried the species through long stretches of seas. Weaver and Clement[16] basing their remarks on a paper of O. F. Cook have indicated that the seed nuts lose their viability after some days due to salt water infiltration. This handicap has been largely overcome by the agency of man—the amphibious Polynesians and the wandering Malays. The migratoriness of the Polynesian seafarers must have been the main cause of the wide distribution of the palm over the islands of the Pacific Ocean. Either as a result of subsidence of their island homes for which evidence is not lacking, or pressure of population in their inelastic confines which tends to drive oceanic islanders to seek new lands, or as vanquished parties in the frequent wars which were a main feature of Polynesian life, these islanders had attempted distant colonization and had overrun parts of Melanesia in early ages. They developed singular navigational skill and nature's bounty in their quest for a new home in the unknown eastern waters, had given them timber and fibre to build huge crafts. A party of these adventurous mariners, remarkable for their powers of endurance and having their native methods of assuaging hunger and thirst in long voyages were probably the pioneers that first planted the Coconut in the New World. The consensus of opinion among eminent authorities on the problem of the Pacific basin today is that contact between the Old World and the New across the Pacific Ocean did not begin till about the close of the fifteenth century though there is probability of some accidental contact earlier than that period. Competent ethnologists including the late Baron Nordenskiold concede the possibility of Polynesian mariners having reached the shores of America within comparatively recent times—recent in an anthropological sense which according to Diamond Jenness[17] is still pre-Columbian. I. H. Burkill[18] cogently points out the improbability of the arrival of the coconut in America much earlier than its discovery since it had not then spread even to the opposite coast of such a narrow isthmus as Panama. The Malays were active sea-farers who had spread to the Eastern Archipelago in the distant past and traces of their emigration are seen throughout Polynesia. They, as well as the once maritime Tamils, together with the ancient mariners of the Bengal coast, have been responsible probably for a much wider distribution of the Coconut into the lands of the Indian Ocean and in this spread ocean currents and the monsoon drifts have undoubtedly played their part. The natural dispersal of the Coconut from the lands of the West Pacific to the islands of the Indian Ocean was rendered easy as there is a strong flow of water from the former to the latter ocean during the North-East monsoon. Of course man has carried the plant all over. But everything seems to point out to some island of the West Pacific as its original home and this as far as we can see is possibly the land now under the waves but which once formed part of the ancient Papua.

So old is the Coconut in India that the Arabs from early times upto now called it the Indian Nut. John of Monte Corvino and Marco Polo, both of the thirteenth century, both named it so. Cosmas in the sixth century described it under its Sanscrit name. To the orthodox Hindu it is the *Kalpaka vriksha* or Tree of Heaven and hardly will he agree when told that it is an alien species come to this land ages ago. The explanation of its vast antiquity is as simple as it is natural. It started from the shores of the ancient Papuan land. The strong eastward current during the North-East monsoon carried it through the Straits of Malacca into the Bay of Bengal and primitive man brought it over to the shores of India in pre-historic ages.

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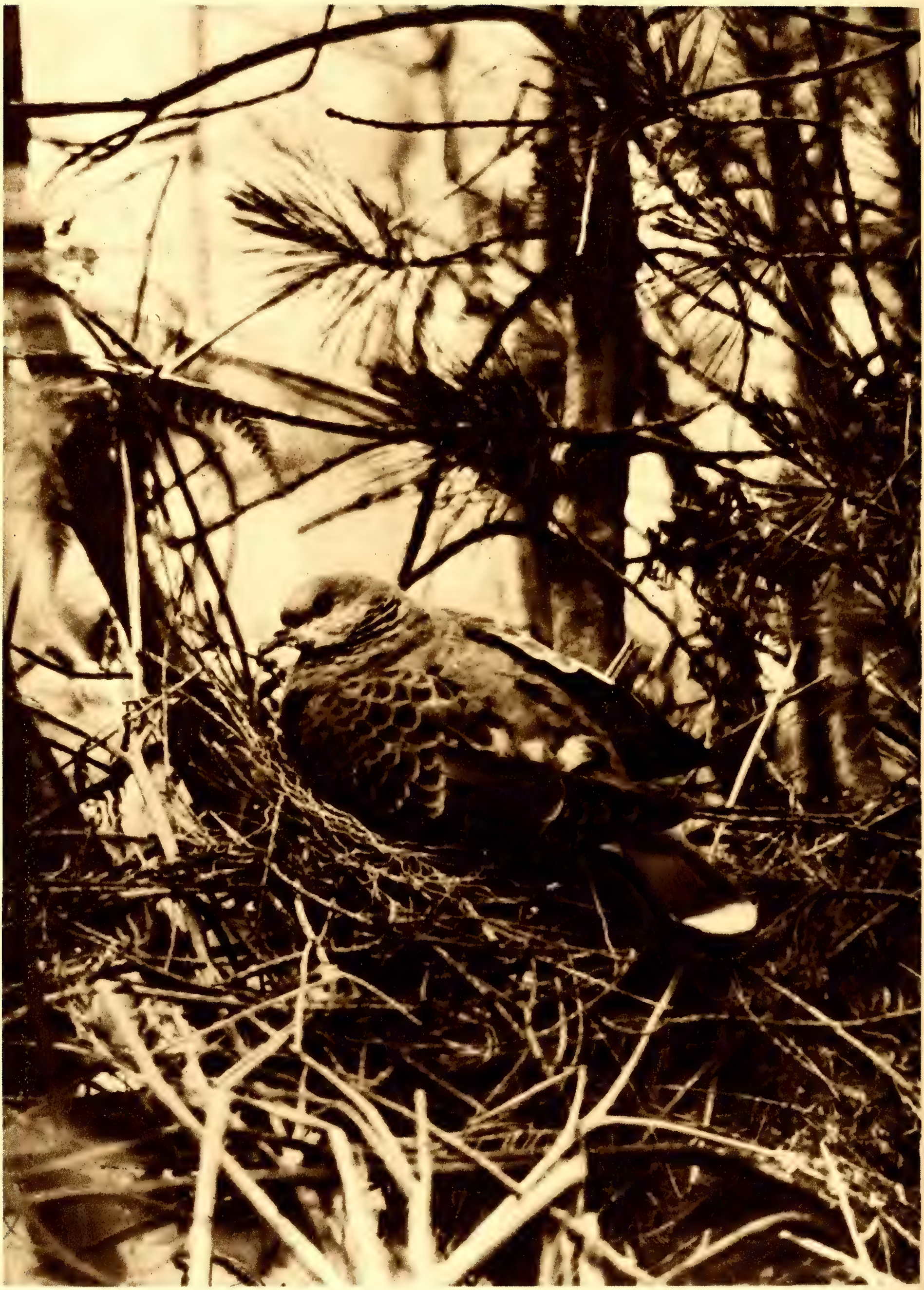


Photo: *R. S. P. Bates*

HIMALAYAN TURTLE DOVE (*Streptopelia orientalis meena*).
Wurjwan, 8300 feet, 3rd July 1937

ROSE-FINCHES AND OTHER BIRDS OF THE WARDWAN VALLEY.

BY

MAJOR R. S. P. BATES.

(*With* 6 *plates*).

To anyone interested in bird study I can thoroughly recommend a trip through the upper Wardwan Valley in the Kashmir province of Kishtwar. Last year, feeling it to be high time to try my luck with birds breeding at the higher elevations, I took two months' leave from June 15th, but in view of our experiences, set forth in the following account, I would advise an earlier start, say June 1st at the latest.

We chose Achhabal as our base, motoring direct from Jammu over the Banihal and meeting servants and kit there on the afternoon of June 18th. On the 22nd we took the Kishtwar trail but on coming over the first gali into sight of the Sinton Pass we bore off to the left, finally camping at Gurdraman in the park-like Upper Naubug Valley, an easy but definitely hot march. After a day's halt we pushed on, meaning to camp at 10,000 ft. for a week on a marg called Naokan where I hoped to get my eye in in preparation for the birds of the Wardwan.

The least said about that camp the better. We hunted for a patch of clean level ground for an hour and a half. Eventually we had to pitch the tent at a fearsome angle which entailed a restless night, being prevented from rolling out of bed only by the judiciously stacked store boxes. Shortly before dark the wind veered into the West immediately filling the air with the horrid stench of putrefying flesh; a dead cow was found forty yards distant in the midst of a patch of viburnum. Seven of the coolies with the aid of a rope soon trundled the carcase down the steep hillside, leaving it where we hoped it would do its worst on the Gujars and Bakribans whose flocks had befouled the only level spots.

It would have been a good place for birds, but we left it the next morning with no regrets. A noisy pair of Variegated Laughing Thrushes in the viburnum bushes saw us off and in a small patch of juniper I found a Hedge-Sparrow's nest with one fresh egg in it. It was an interesting and to begin with a thoroughly enjoyable march but take heed and put not your faith in the half-inch map. It was constructed by a humourist who put a little note in the margin 'Inshan 6 miles'. And so it may be, as the crow flies, but at the end of the day we reckoned we had tramped little short of 20 miles, exclusive of playing about for a couple of hours on the summit of the Margan Pass.

A two thousand foot climb up a fairly steep boulder-strewn slope had brought us to a heavenly two mile stretch of almost level marshy ground. The meadows were covered with blue and white anemones, buttercups and a blue corydalis. Round the marshes bright yellow trollius and rose primulas were much in evidence. Straight ahead a fine series of snowy peaks proclaimed Nun Kun, while on our right a further two thousand feet of steep slope was stippled in shaded stretches of vast extent with the tiny cream flowers of the dwarf Rhododendron anthopogon. Marmots shrilled from every patch of rocks making the dogs quite wild with excitement, while for me there were birds in plenty. I disturbed a flock of feeding Rose-Finches. It was to cope with Rose-Finches in particular that I had chosen the Wardwan.

It was 6 p.m. before we got down to the river after tramping round bare shadeless spurs for six or eight miles at an elevation of never less than 11,000 ft. before coming to the abrupt drop through the forest to Inshan. The only redeeming feature was that we came on a primula new to us, the charming white *Primula involucrata* which grew in little clusters in damp spots between the spurs.

On reaching the Wardwan river we hailed with joy the news that upstream was the last forest hut in the valley. Wearily we dragged ourselves the extra mile and a half and took possession, thankful to get out of pitching the tents.

At this point, and in fact for most of its length, the Upper Wardwan is a comparatively open wide vale. Villages are spaced at increasing intervals as far as Suknes. Up to there the stony soil is tilled with but fair success, rice being imported in exchange for home-spun blankets to supplement the insufficient crops. Above the point we had reached, to work the dwindling forests is no longer an economical proposition, but I confess that did not depress me; it is a grand country for birds.

In the mornings the pine wood sheltering the F.R.H. was filled with their voices. In front of the hut was a 'kuth' nursery, the ripening heads of which attracted many Goldfinches. Kashmir Sooty Flycatchers were exceedingly common: I marked down four nests within a hundred yards radius. Two pairs of Blue-headed Rock-Thrushes lived near by but the young ones had just left their nests, one of which I found—of pine needles as usual—tucked into the buttress roots of a tall tree. We were also visited by those mysterious Red-browed Finches but if they had nests, as usual they were not giving away their positions. Meadow Buntings were common both within and without the forest. One pair actually had a family of large young ones, fifteen feet from the ground in a thick fir tree. In the fields a few pairs of Larks were often singing, but Greenfinches were the most numerous birds in the open lands.

By the side of a stream I obtained some good photos of a White-capped Redstart, whose nest we found on June 27th with large young ones in it. I was also most successful with a Himalayan Turtle Dove which had built a scanty nest of roots only a foot from the ground on some brushwood at the foot of a sappling in a small spinney. The light seemed hopeless in such a sheltered position but the bird sat still enough for time exposures.

The most interesting birds of all however were by the river.

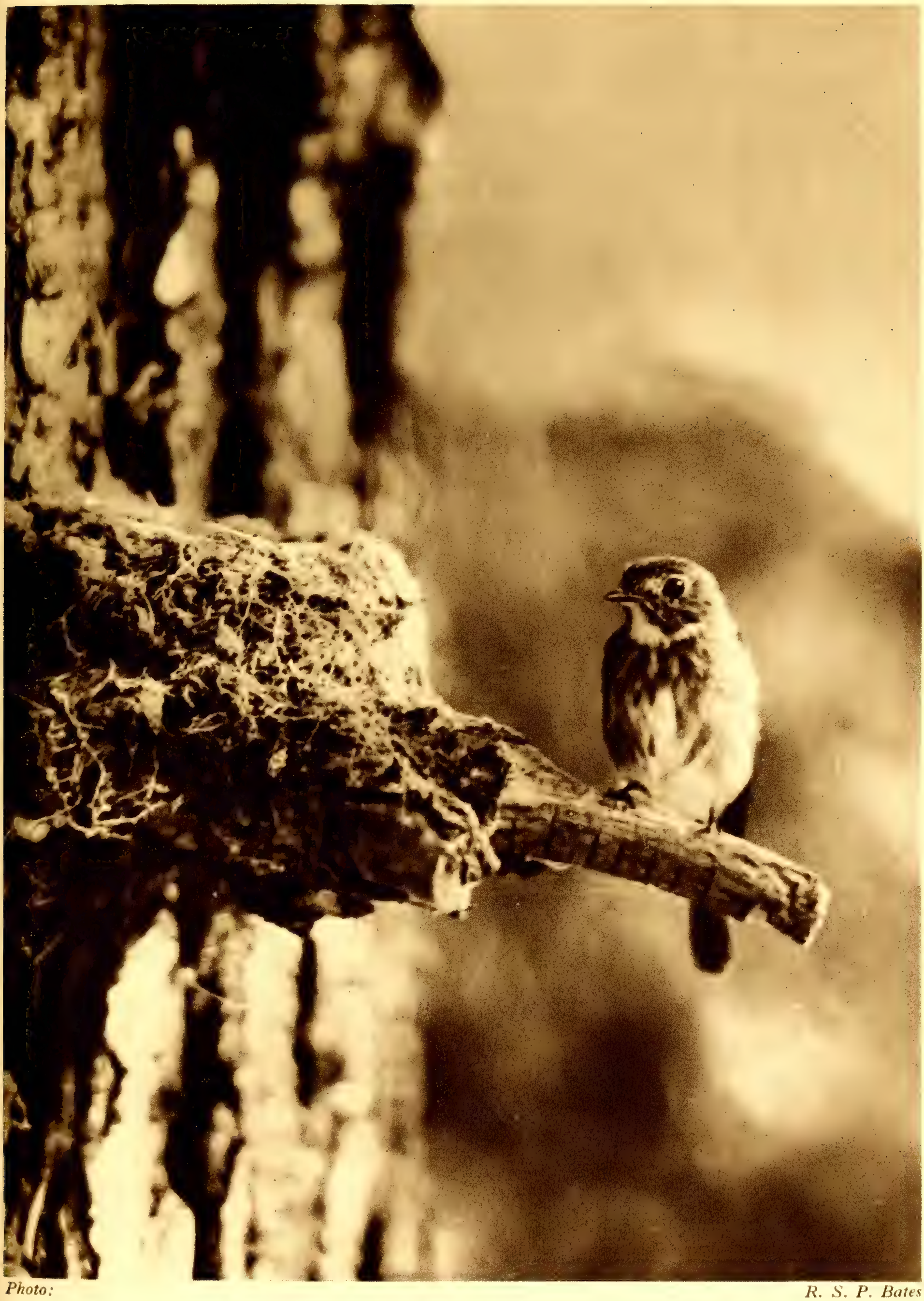


Photo: R. S. P. Bates

KASHMIR SOOTY FLYCATCHER (*Hemichelidon sibirica gulmergi*).
Wurjwan, 8300 feet, 1st July, 1937.

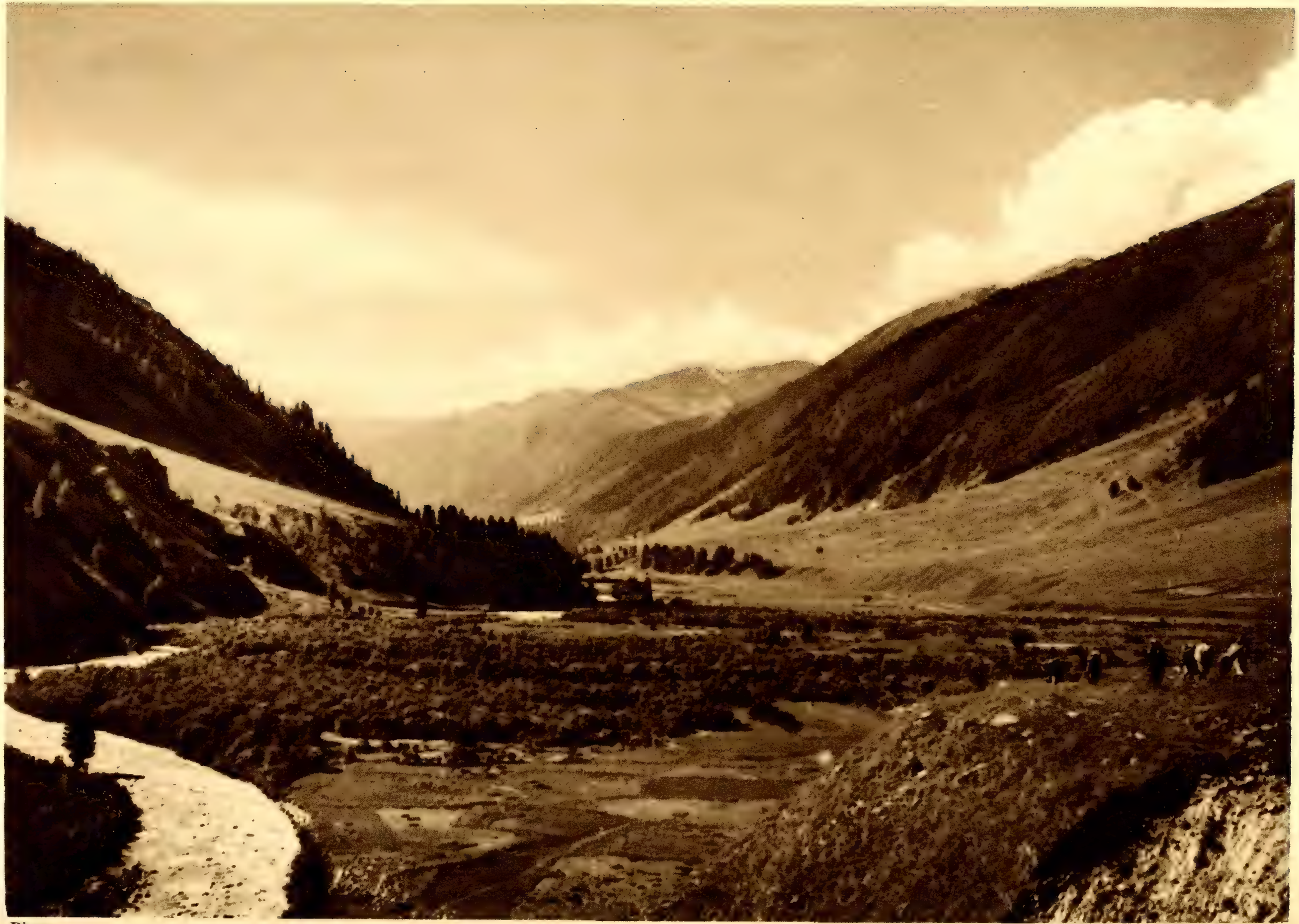


Photo: R. S. P. Bates

DELTA AT JUNCTION OF BASMEN NULLAH WITH WARDWAN RIVER WHERE LARGE NUMBERS OF HODGSON'S ROSE FINCHES WERE NESTING IN JULY

Around Inshan and for a few miles upstream there are many bush-covered islands with stony margins. Some were easily accessible and of considerable size. Grey and Hodgson's Pied Wagtails and Sandpipers galore were naturally the commonest denizens here, but it was not long before I realized that the strange Ibisbill was by no means rare. For some days I watched four pairs of these curious birds but eventually I was reluctantly forced to the conclusion that their nidification was over for the year, in spite of the fact that they used to fly backwards and forwards crying peevishly whenever we invaded their particular haunts.

On one occasion, on July 9th, while searching one of the largest islands, I came upon a Japanese Wryneck feeding young ones in a crevice near the top of a thirty foot tree. Stepping back into the cover of some bushes in order to watch it unobserved, I almost fell over a down-covered young Himalayan Brown Wood Owl. It could only fly a few yards at a time so must have been reared on the island. While photographing it, one of the parents arrived using the most obnoxious language.

On June 26th I thought I was at last to be permitted to photograph a Monal Pheasant at the nest but returning to erect the hiding tent not half an hour after Guffara, the Shikari, had discovered it, we found the eggs gone. A search resulted in the recovery of a piece of wet shell beneath a stump 40 yards distant. A thieving Jungle Crow was probably responsible for the disaster. There had been only three eggs in it, but we found the stained remnants of two others in a leaf-filled hollow 10 ft. below the nest which was on a steep forest-clad hillside between two close-growing pine trees where undergrowth was conspicuous by its absence.

The day after arriving at Wurjwan I noticed a Buzzard circling above our wood, and a couple of days later picked up half an egg-shell a hundred yards behind the hut. I was not therefore particularly surprised to come across a fledgeling on June 30th sitting not fifteen feet up on a dead branch just as I was turning into the wood. It was quite unafraid and I doubt if it had been twenty-four hours out of the nest. Next day I shot it, its death being unfortunately necessary in order to determine the breeding race of the North-West Himalayas. That problem is now solved satisfactorily but to fathom what name this race should bear is evidently a harder task.

The only other bird I photographed with fair success at Wurjwan was a Skylark. On alarm it was amazingly quick in its movements and although I pressed the release when its bill was inside a young one's gape, the photograph shows the head up and the wings commencing to open.

On July 11th we moved to Basmen about eight miles further up the valley at approximately the same elevation, 8,500 ft. Within an hour of starting we passed through the most charming glade just short of Tsuidraman village. It looked the most delightful of camping spots and I was sorely tempted to curtail the march.

We reached Basmen early, so while setting the camp in order and while my wife was ministering to the needs of the halt and the maimed and the pathetic little ill gujar babies brought in by their trusting parents, I sent the shikari out to prospect. He returned with the most amazing news. He had found a nest of the Simla Streaked Laughing-Thrush with three eggs in it and seven other nests, all, he said, containing blue eggs with black spots on them. Had we come up with the Rose-Finches at this low elevation? We certainly had. Within the next couple of days we must have found a score of nests of this, Hodgson's Rose-Finch, which was excessively common breeding in bushes of various kinds from about 2½ to 7 feet from the ground. Most of them were pretty well concealed but I saw two quite exposed in willows and one on the outer edge of a wild rose-bush. The eggs were incubated; I was quite unable to find fresh ones. All these birds must have finished laying about the last week in June. Some of them contained only three eggs, the majority four. I managed to obtain one photograph with both parents at the nest. The male seemed bent on feeding his three newly-hatched chicks on regurgitated seeds but the female swallowed all his offerings, thereafter proceeding to bring them up as required for the next half hour when more fully digested.

The reason for this concentration of Rose-Finches is evident from the photograph taken as we were leaving Basmen. Here a side river of considerable importance flows into the Wardwan, and as the valley at this point is comparatively wide and flat, it has formed a considerable delta. Every channel is bordered by willows, the islands and strips of land between being at times densely clothed with bushes of many kinds. Nowhere else either up or down the valley did I see any spot like it. However, Rose-Finches were by no means uncommon from here upwards breeding mostly in tall weeds and bracken. Amongst the bushes in the Basmen delta was a delightful small-leafed rose-bush bearing deep yellow single blooms. A double white cottage rose was also not uncommon.

At Basmen we had pitched the tent amongst some boulders a little way up the side nullah to get away from the village. Alas we were intruders on the preserve of a pigmy hare—a quaint reddish-fronted little chap the size of a guinea pig. Nothing daunted by our intrusion he used to waggle his whiskers at us from the top of a rock close to the tent door. I was actually able to take four photographs of him, the last at only 3½ feet. Twice in spite of the dogs I found him nibbling grass inside the bathroom portion of our canvas home.

On July 17th we moved up a thousand feet to Suknes, the very last hamlet in the valley. The headman wished us to camp on a hilltop overlooking his village, but fortunately we made for the opposite side of the river, the left bank, where there were still a few woods and hopes of an uncontaminated water supply. We crossed the tumultuous river by a rickety wooden bridge of the usual type and explored some barren fields along the edge of a steep wood commencing in clumps of deciduous trees—a charming piece of country. Finding only one rather muddy trickle of water we moved up half a mile over a long spur and found ourselves in a charming little side valley which did not begin its

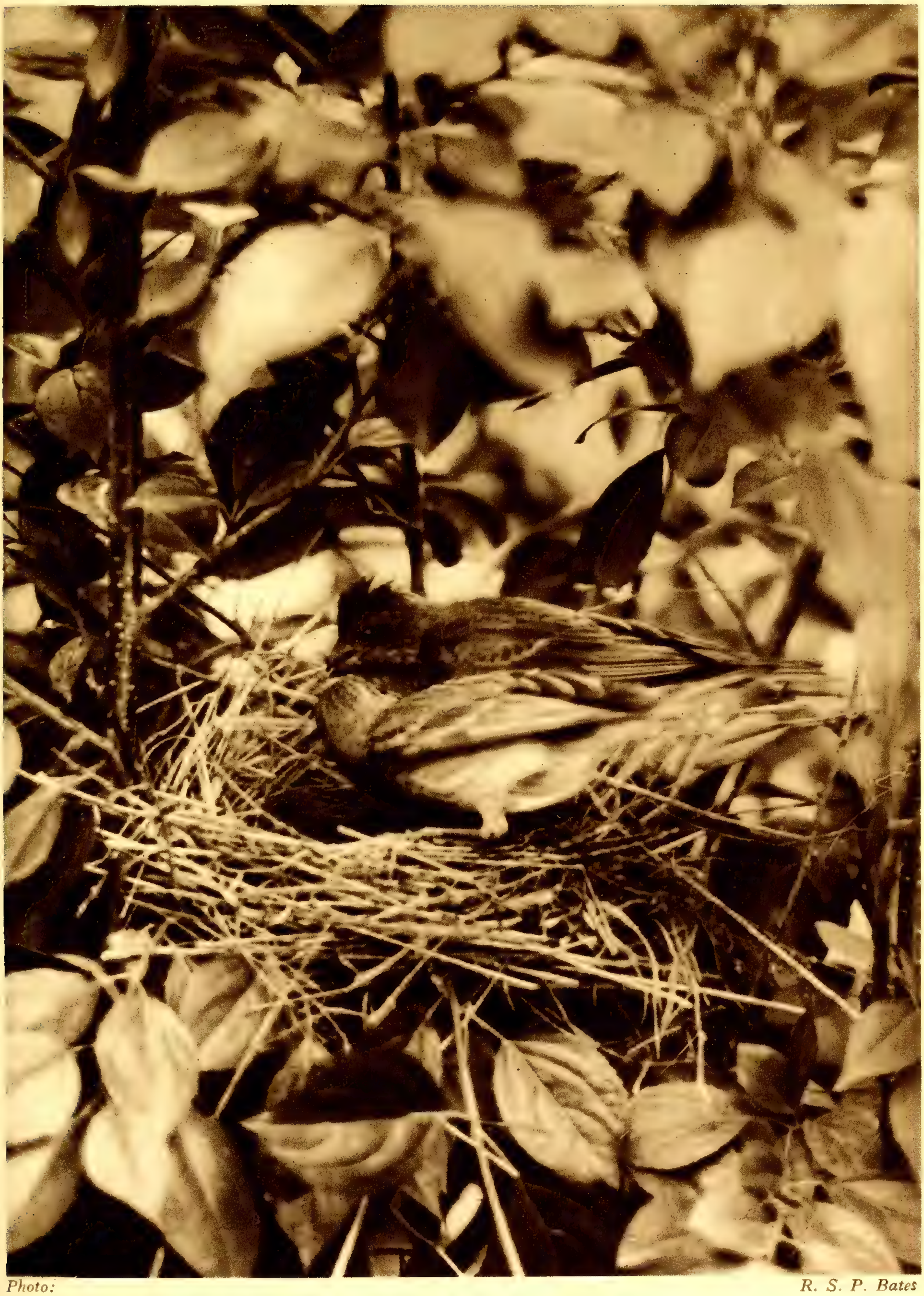


Photo: *R. S. P. Bates*

HODGSON'S ROSE-FINCHES (*Carpodacus erythrinus roseatus*).
Basmen, 8500 feet, 16th July, 1937.

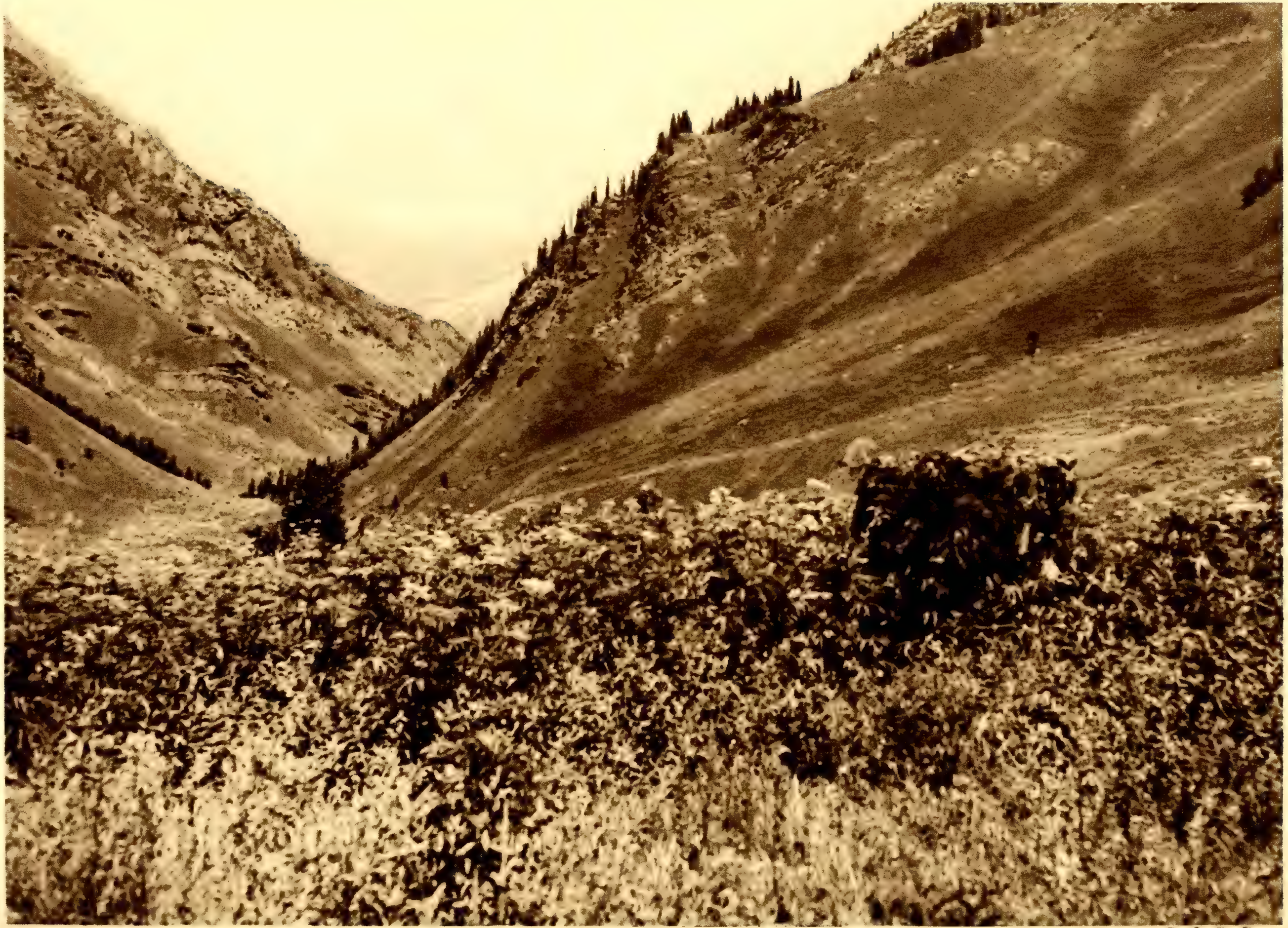


Photo: R. S. P. Bates

Suknes, 9100 feet, 25th July, 1937

abrupt upward sweep for a thousand yards from the main river. A narrow tongue of forest ended close to a series of springs, so here in the shade of the last trees we pitched our camp.

Somehow the character of this part lying at 9,300 ft. above sea-level struck me as being different from other Kashmir valleys I have explored. The herbage was rank—there is no other word for it. Patches of a tall fleshy weed bearing large flowering heads packed both slopes and level spaces between the sketchy fields. In places these weeds must have been six feet high. The steeper slopes were clothed in bracken. Before we could pitch camp we had to slash away deep grass and weeds through which glorious flowers were pushing their way—Canterbury Bells, tall Monkshoods, deep blue Delphiniums. Stately Mallows and Himalayan Scabious were just coming into flower, and within a few feet of the back of the tent where the deeper forest shade commenced Polyphyllum lilies were almost profuse. One such plant I found with a dozen blooms upon it and as many buds, growing on a stem nearly six feet high. This I photographed in colour.

Other evidence of a danker climate was to be found in the particularly hefty mosquitoes which in the evenings necessitated a lavish use of citronella. Fortunately they seemed to be active only round about dusk. We could therefore put up with them but loathsome earwigs were an absolute pest. Every night I used to brush dozens of them off the top of the tent immediately over our beds and it became almost impossible to cope with them in the store boxes. From Suknes we were never free from these vile insects until we left Kishtwar behind us. There seems no doubt that the Wardwan enjoys a definite monsoon period. Throughout almost every morning of July we could see the heavy clouds piling up from the South and creeping in between the curve of the Pir Panjal range and the massive slopes to the North-East.

I have dwelt particularly on the character of this part of the valley as it was here that I made a discovery of some importance. On July 23rd returning from the river towards camp along the spur with weed patches on either flank, I noticed a little bird singing lustily from the top of the tallest weed in view. I could hardly believe my eyes. It was undoubtedly a Reed-Warbler. A careful search revealed a nest twenty yards down the hillside with the female sitting on two eggs, one of which was definitely abnormal, being very small. The nest had a heavy list as it was built round the main stem of the weed with no further support of any kind. I put the hide up immediately and got a fine series of negatives with very little trouble, after which I proceeded to shoot the female off the nest to make certain of identification. A quotation from my diary sums up the position. 'From the excellent vocal efforts of the male I first thought it might be *dumetorum* but the wing formula does not agree at all. Is it a *concinens* after all and is there still a mix-up over these races?' It was a *concinens* and what is more the same bird as the one which breeds so profusely in all the swamps of the main vale of Kashmir. I gather this discovery has confirmed Mr. Hugh Whistler's suspicions that the Kashmir bird which he separated a few years ago as *hokrae* is in reality *Acrocephalus concinens harringtoni,* the race found breeding on open hillsides of the North-West Frontier.

Subsequently I found that most of the larger weed patches were each occupied by a pair of these Reed-Warblers. They must breed here mainly during June and July, commencing as soon as the weeds are sufficiently tall as I was able to find only one more nest still occupied. This had three large but almost naked young ones in it on July 25th. Unlike the first one this nest was a typical Reed-Warbler's in construction; a deep grass cup, one side twined firmly round the main stem of a weed 18 inches from the ground with two smaller stems supporting it at other points of the rim. It was near the edge of a patch growing on level ground between two of the stony fields.

I really had a very successful time at Suknes as I also obtained good photographs of a Jerdon's Hedge-Sparrow and a Hodgson's Shortwing at their respective nests. Unfortunately the light was particularly bright on both occasions causing very strong contrasts. As ill luck would have it, just as the negatives were due to come out of the developer I spilt the whole of the fixing solution. By the time I had prepared a fresh supply they were of course over-developed. As I was developing for as soft a negative as possible under the circumstances, this was indeed a mild disaster.

A pair of Hodgson's Rose-Finches were building on our arrival in a little perrottia bush 15 feet behind the servants' tents. We quite expected them to desert but they had three eggs before we moved on. I also found two nests of this species in thick bracken both with 4 well-incubated eggs in them.

We had intended moving up to the foot of the Bhotkol glacier, where I hoped to find Redstarts and Rubythroats breeding and with any luck White-browed Rose-Finches whose nesting habits remain a mystery. But the weather had deteriorated so much that we hung on at Suknes longer than intended. Time was getting short and no signs of a break in these monsoon conditions appeared imminent. We therefore reluctantly decided to make straight for Rangmarg, cross the Gulol Gali (14,500 ft.) on the first good day and drop into the East Lidar where conditions might be less inimical to bird photography. I knew from previous experience that around Zojpal there are Redstarts, Rubythroats and Tickell's Willow-Warblers in plenty. We fixed on July 27th to push our camp a few miles up the river to Wanhoi preparatory to crossing the ridges to Rangmarg. Wanhoi consists of a small stony space just large enough to hold a camp. Just beyond the river forks. The East branch rises steeply to a wide scored-out valley lying at about 11,500 ft. left by the retreat of the glacier's snout. This is the head of the Wardwan and the road to Suru. The West or rather North-West branch flows from the Sain Nullah through abrupt cliffs, consequently one has to climb a few thousand feet over the obstruction to get into this sequestered little vale.

Our luck was out. Every time we moved we got soaked to the skin. It started to rain soon after leaving Suknes and kept it up until after we had pitched camp near the snow-bridge which is now the sole means of crossing to the Suru path. The bridge which

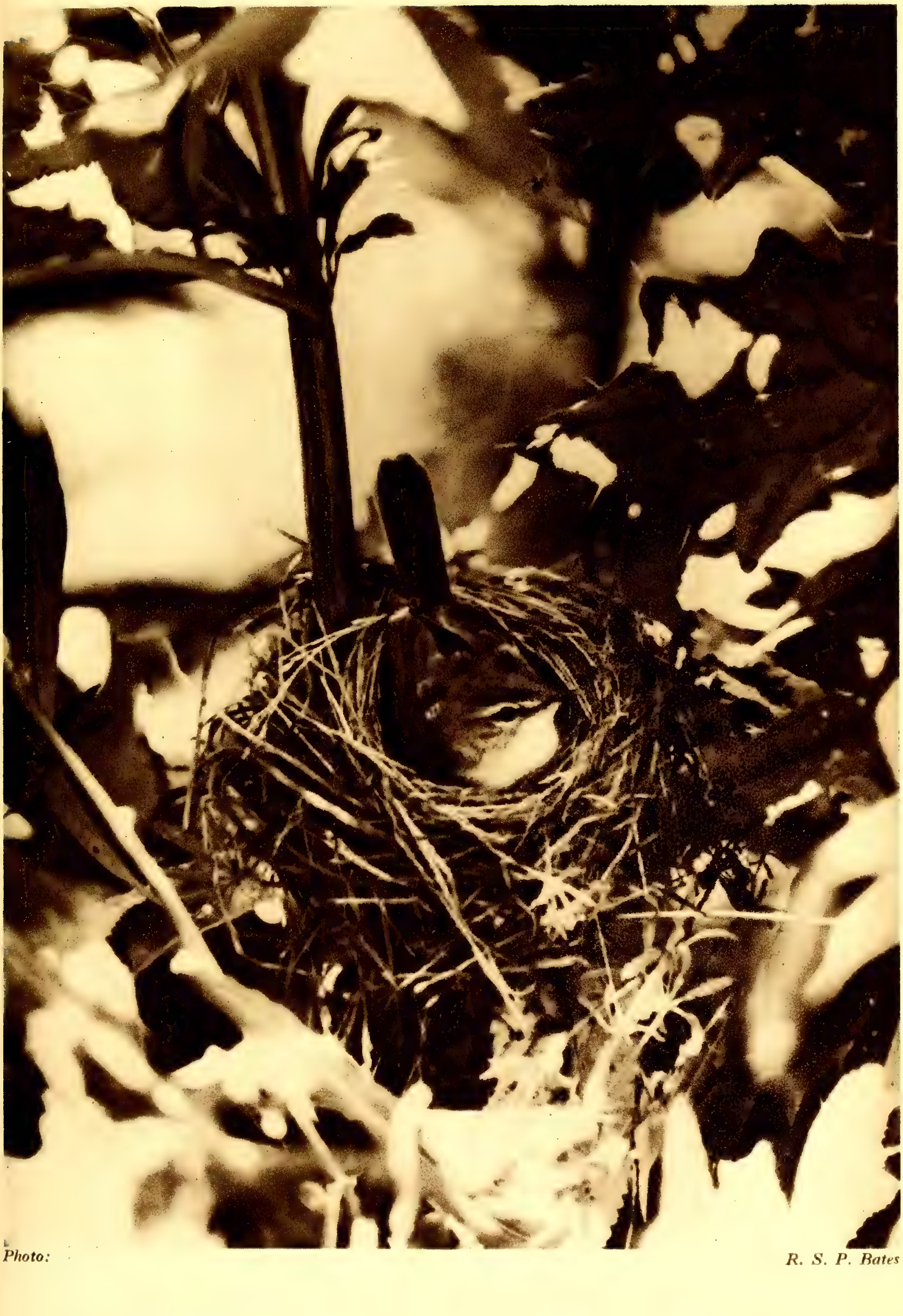


Photo: R. S. P. Bates

WITHERBY'S PADDY-FIELD WARBLER (*Acrocephalus concinens haringtoni*).
Suknes, 9100 feet, 24th July 1937.

B. B. Osmaston writes of building during his return from Suru (vide *Journal* vol. xxxi, p. 194) has since been swept away and no one has been enterprising enough to rebuild it.

Next morning we started to climb immediately to circumvent the junction cliffs. Nearing the top of a ridge a cruising Eagle put up a Monal Pheasant which went whistling close over my head. It was followed shortly by a couple of chicks.

We had hoped for fine views of the glaciers around Nun Kun, but down came the clouds and we were soon almost lost in wreathing mists and driving rain. Lush grass and fields of dripping flowers, columbines, Jacob's ladders, asters, brushing against us whenever we left the ill-defined path soaked us to the thighs, while cold blasts of wind and rain helped to add to our sorry plight. Descending greasy shale slopes under these conditions was most unpleasant. A dozen times I saw visions of finding myself at the bottom in record time but minus the seat of my pants. However, after crossing two unpleasantly swollen streams, where one of the dogs, after first nearly pulling me into an uncomfortably turbulent pool, dislodged a stone from the steep bank which caught me a resounding crack on the knee-cap, we arrived at the flat space called Rangmarg just as the rain ceased.

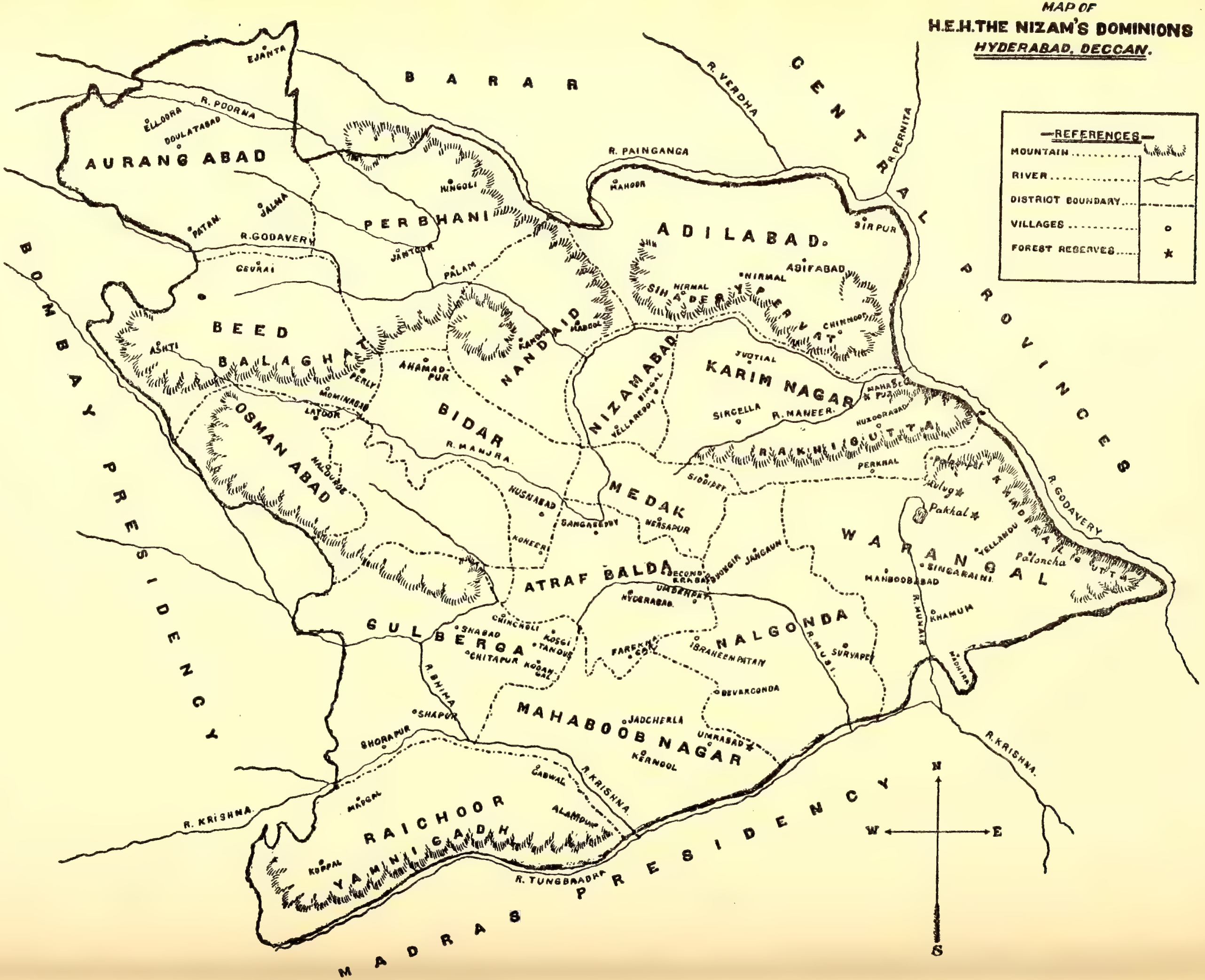
We put our tents on a narrow fold near the Gulol stream where there were tufts of large gentians of two kinds growing within twenty yards of one another, the pale blue wide-mouthed Moorcroft's Gentian on the Southern face and the taller narrow Gentiana decumbens where the trend of the ground was to the North.

But for a few patches of birch the Sain Nullah is devoid of trees. Even the juniper is represented only by a few straggling patches. This state of affairs I suspect to be due to the depredations of the large flocks of goats. The bottom of the valley however provides good pasturage for some Gujars' buffaloes. Here I saw a number of Hodgson's Yellow-headed Wagtails, but during the one day we spent there it became obvious that I was unlikely to find the Rubythroats and Rose-Finches nesting there.

Our day of rest was brilliantly fine, so of course we decided to do the stiff 4,500 ft. climb to the Gulol Gali the very next morning. At dawn patches of blue sky showed through occasional rifts in a thick mist. We soon lapped up the first thousand feet and crossed the slope of broken rocks flowing down between the steep cliffs we had seen from below. Here I saw a Wall-Creeper feeding a large young one seated on a ledge. After that birds were conspicuous by their absence except for a few Yellow-billed Choughs and a flight of Snow-Pigeons. But the Gulol Gali is a disappointing pass. It consists largely of unstable disintegrating shale slopes where few plants can ever get a hold, and with nothing about it to attract birds, particularly in such weather as we encountered.

Just as we got safely over the stone shoot, which must be rather dangerous in wet weather, the blackest clouds I have ever seen rolled up from the Junction and from across the valley. They met soon afterwards, resulting in the rest of that toilsome ascent being carried out in a series of heavy downpours and with all the hoped-for distant views blotted out.

The narrowest of cols which forms the summit was reached at midday. It was most curious to crouch down in an almost dry still pocket with swirling mist and rain driving almost vertically upwards from the further side blown in furious gusts of wind from the East Lidar valley. We pulled down our earflaps, put down our heads, and charged over the ridge down the further slope until we had dropped four or five hundred feet and found the shelter of a large boulder. We reached Zojpal three hours later just as the rain at last stopped, and were settled into camp in time to watch one of the most heavenly sunsets I have ever seen. Our adventures in the Wardwan were over.



MAP OF
H.E.H. THE NIZAM'S DOMINIONS
HYDERABAD, DECCAN.

—REFERENCES—
MOUNTAIN
RIVER
DISTRICT BOUNDARY
VILLAGES
FOREST RESERVES
B A R A R
C E N T R A L P R O V I N C E S
B O M B A Y P R E S I D E N C Y
M A D R A S P R E S I D E N C Y
AURANG ABAD
PERBHANI
ADILABAD
BEED
BALAGHAT
NANDAID
NIZAMABAD
KARIM NAGAR
OSMAN ABAD
BIDAR
MEDAK
WARANGAL
ATRAF BALDA
GULBERGA
NALGONDA
MAHABOOB NAGAR
RAICHOOR
SIHADERY PERVAT
RAKHI GUTTA
YAMNIGADH
EJANTA
ELLOORA
DOULATABAD
R. POORNA
JALNA
PATAN
R. GODAVERY
GEVRAI
ASHTI
HINGOLI
JANTOOR
PALAM
R. PAINGANGA
MAHOOR
SIRPUR
ASIFABAD
NIRMAL
CHINNOOR
R. VERDHA
R. PERNITA
AHAMADPUR
PERLY
MOMINABAD
LATOOR
NALDURGE
R. MANJRA
KANDAR
MADHOL
SIRCALLA
JUGTIAL
R. MANEER
SINGAL
YELLAREDDY
MAHADEVPUR
HUZOORABAD
PERKHAL
SIDDIPET
HUSNABAD
SANGAREDDY
NARSAPUR
KOHEER
JANGAUN
BHONGIR
SECUNDERABAD
UMBERPET
HYDERABAD
CHINCHOLI
SHABAD
CHITAPUR
KOSGI
TANDUR
KODANGAL
FAREKHNAGAR
IBRAHEEMPATAN
DEVARCONDA
R. MUSI
SURYAPET
Pakhal
Mulug
Palvancha
YELLANDU
SINGARAINI
MAHBOOBABAD
KHAMUM
MADHIRA
R. MUNAIR
R. BHIMA
SHAPUR
SHORAPUR
JADCHERLA
UMRABAD
KERNOOL
R. KRISHNA
GADWAL
ALAMPUR
MADGAL
KOPPAL
R. TUNGBHADRA
N
S
E
W

(Issued as an accompaniment to 'Flowering Plants of Hyderabad State.')

A FURTHER CONTRIBUTION TO SOME OF THE COMMON FLOWERING PLANTS OF THE HYDERABAD STATE; THEIR DISTRIBUTION AND ECONOMIC IMPORTANCE.

DICOTYLEDONS

BY

M. Sayeedud-Din.

(*With a map*).

Introduction.

The present paper places on record some of the dicotyledonous plants collected and identified by the author since the publication of his last paper[1] on dicotyledons. In order to widen the scope of this paper some of the commonly cultivated plants are also listed. Its scope is further widened by the inclusion of material from several representative districts—representative in the sense of their floristic characteristics—of H.E.H. The Nizam's Dominions.

The two large distinct divisions of this extensive land, viz., the Marathwari and the Telangana are not only distinct as regards their geology but are also markedly different in their floristic composition. Out of the places visited for the collections for this paper Aurangabad District is typical of the Marathwari side, and Warangal District typical of the Telangana side. Plants from the following places are listed in this paper—Ajanta, Phoolmari, Doulatabad, Khuldabad (Aurangabad District); Nizamabad District; Mulug, Pakhal (Warangal District); Vikarabad, and the suburbs of the Hyderabad City.

A few words must be said regarding the topography and ecology of some of the important localities, if the reader is to get a general idea of the floristic composition with reference to the different habitats. In the vicinity of the Hyderabad city, Adigmet presents an interesting flora, and is therefore worthy of a little consideration. It is an open country full of characteristic boulders, and the highest place, 1,725 feet above sea level is occupied by the Osmania University. The soil is gravelly with sheets of big rocks underneath at several places. Naturally the soil does not retain water for any considerable length of time, and the plants show marked xerophytic characters. The following communities are readily distinguished: the *Turf-community,* consisting of small herbs which are found in a marked association on untrodden portions of lawns and grassy places; the *Sand-binders,* which are in abundance and serve to bind the sand; the so-called *Mat-plants* which spread out like a mat without much binding the sand. Then there are the cosmopolitan weeds and shrubs. Trees are scarce. The majority of the trees found round about Adigmet are those planted for shade. The natural growths are perhaps only the Acacias, Ficus and a few other plants belonging to different families. In summer the ground lies bare except for a few hardy herbs and grasses. A great damage is being done to the natural vegetation by the grazing of cattle. The effect of grazing on the vegetation of Adigmet will form the subject of a subsequent paper. So far about Adigmet.

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[1] The Paper published in *J.A.S.B.*, vol. i, p. 9 (1935), is 'Dicotyledons—Part I '

As I have to a great extent already dealt with the Warangal District on the Telangana side in my last paper, I shall now briefly describe the topography and ecology of the Aurangabad District on the Marathwari side. Aurangabad lies north-west of Hyderabad. Travelling along the Marathwari side towards Aurangabad one comes across with very poor tree-vegetation, except for the several species of *Acacia* along vast expanse of cultivated land and for distantly scattered patches of forests. The soil is typical black-cotton soil and apart from cotton many useful crops already detailed in the last paper are grown. The chief Hill Range—the Sahyadri Parvat—running along the north, from Nirmal in Indur District in the east, reaches Ajanta after passing Parbhani. Hundred miles of its length are styled as the Ajanta Hills. It is here that thick vegetation is met with, and some of our collections were made along this region. The flora of the river-beds in this part of the country is very interesting. Further collections were made along the country between Doulatabad and Ellora. The vegetation of the valleys near the Ellora caves presents a marked contrast to the vegetation met with in scrub jungle. The forest on this side seems to be a Rain-forest and a transitional form between rain and monsoon-forest in contrast to the mixed deciduous forest and Rain-forest on the Telangana side. Apart from these the typical thorn-forest consisting of the dominant members of the Leguminosæ family, and the open forests are also readily distinguishable.

The families have been arranged in accordance with the classification adopted by Bentham and Hooker in *Genera Plantarum.* Altogether 255 species belonging to 70 families have been recorded. Apart from the economic uses mentioned the plants of medicinal importance have been marked as such, and their medicinal properties may be referred to in the literature cited and to any further literature existing on the subject. Regarding the botanical names of plants the most common and well-known names are given, although in some cases synonyms have also been given especially when different names are used for the same plant in standard works, thus making the work of reference comparatively easier.

ACKNOWLEDGMENTS.

I am indebted to my assistants Messrs. M. A. Waheed and Sri Ram Loo, and particularly to Mr. M. Abdus Salam who has

been of great help to me in my tours for the collection of the material. My thanks are due to Mr. Mayuranathan of the Madras Museum who has kindly confirmed some of the doubtful species after comparing them with the type-specimens. I am very much thankful to Dr. B. Sahni for his suggestions and appreciation of the work on the flora of Hyderabad. I cannot adequately express my thankfulness to Sir Arthur Hill and Prof. F. E. Fritsch for their encouragement.

SYSTEMATIC ACCOUNT.

I. RANUNCULACEÆ.

1. **Clematis Gouriana** Roxb., *H.F.B.I.*, i, p. 4.
(Indian Travellers' Joy).

Vernacular name.—*Morvel* (Mar.).

Habitat.—Western Himalayas to Ceylon, extending to Java and the Philippines; throughout the Bombay Presidency both in the Konkan and Deccan. I have not so far found it wild in Hyderabad, but it is successfully cultivated in gardens.[1]

Uses.—Leaves are medicinal.

II. DILLENIACEÆ.

2. **Dillenia indica** Linn., *H.F.B.I.*, i, p. 36.

Vernacular name.—*Chalta* (Hind.); *Karmbel* (Mar.); *Kalinga* (Tel.).

Habitat.—Himalayas, from Nepal to Assam; Behar and Ceylon. Cultivated as an ornamental tree.

Uses.—Bark, leaves and fruits are medicinal.

III. MAGNOLIACEÆ.

3. **Magnolia grandiflora.**

Habitat.—Cultivated. Flowers in April.

IV. MENISPERMACEÆ.

4. **Cocculus macrocarpus** W. & A., *Cooke. Fl. Bomb. Pres.*, Pt. I, p. 20

Habitat.—Wild on the Anantgiri Hill, Vikarabad.

V. BERBERIDACEÆ.

5. **Nandina domestica** Thunb., *Willis's Flow. Plts. and Ferns*, p. 443.

Habitat.—Native of China and Japan. Cultivated.

VI. NYMPHÆACEÆ.

6. **Nymphæa stellata** Willd., *H.F.B.I.*, i, p. 114.

Vernacular name.—*Nilkamal* (Hind.).

Habitat.—Common in ponds and tanks. The collection was made towards Kamareddy side. Flowers in October.

There are two varieties :—

(*a*) *parviflora* H.F. & T.—flowers small, blue.

(*b*) *versicolor* H.F. & T.—flowers large, white, blue, purple or flesh-coloured.

Uses.—Roots and seeds are edible, especially in famines. Rootstock and flowers are medicinal.

7. **Nelumbium speciosum** Willd., *H.F.B.I.*, i, p. 116.

Vernacular names.—*Nilofar, Kanwal.*

Habitat.—Common throughout India. Extensively cultivated for its magnificent flowers.

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[1] This plant has since been collected from the Telangana forests.

Uses.—Filaments, seeds, leaves and roots are medicinal. Underground stems are eaten. The flowers are considered sacred and are worshipped by the Hindus.

VII. FUMARIACEÆ.

8. **Fumaria parviflora** Lamk., *H.F.B.I.*, i, p. 128.
Vernacular names.—*Pitpapada* (Hind.); *Tura* (Tam.); *Chatarashi* (Tel.).
Habitat.—A common weed on cultivated ground.
Uses.—Except the root entire plant is used in medicine.

VIII. CAPPARIDACEÆ.

9. **Gynandropsis pentaphylla** DC., *H.F.B.I.*, i, p. 171.
Vernacular names.—*Hulhul, Hurhur* (Hind.); *Mambli* (Mar.); *Vela-kura* (Tel.).
Habitat.—A common weed in waste places.
Uses.—Seeds, leaves and roots are medicinal.

10. **Capparis spinosa** Linn., *H.F.B.I.*, i, p. 173.
Vernacular name.—*Kabra* (Hind.).
Habitat.—A prostrate shrub often seen in dry places.
Uses.—Root and root-bark are medicinal.

IX. VIOLACEÆ.

11. **Viola odorata** Linn., *H.F.B.I.*, i, p. 184.
(Sweet Violet).
Habitat.—Kashmir etc. Cultivated for its flowers.

12. **Viola tricolor** Linn.
(Pansy).
Habitat.—Cultivated for its handsome flowers.

X. BIXACEÆ.

13. **Cochlospermum Gossypium** DC., *H.F.B.I.*, i, p. 199.
Syn.—*Bombax gossypium* Linn.
Vernacular names.—*Kumbi, ganiar, gangal* (Hind.); *Gungu, gondugogu* (Tel); *Kalir-gond, Kathalya gonda* (Mar.).
Habitat.—May be it is wild, but I have not found it so far. It is cultivated.
Uses.—A kind of silk cotton obtained from the seeds is of economic importance. Gum, leaves and flowers are medicinal.

14. **Flacourtia Ramontchi** L'Hérit., *H.F.B.I.*, i, p. 193.
Vernacular names.—*Bilangra, Katti* (Hind.); *Kangregu* (Tel.).
Habitat.—Wild in many parts of India, also in the Hyderabad forests. Cultivated.

15. **Hydnocarpus Wightiana** Blume., *H.F.B.I.*, i, p. 196.
Vernacular names.—*Kowti* (Hind.); *Niradivittulu* (for seeds Tel.).
Habitat.—The Konkans and Kanara chiefly on hill ranges near the coast. Cultivated for its medicinal importance.
Uses.—The oil from the seeds is medicinal.

16. **Oncoba spinosa.**
Habitat.—Cultivated.

XI. POLYGALACEÆ.

17. **Polygala chinensis** Linn., *H.F.B.I.*, i, p. 204.
Vernacular names.—*Miragu* (Hind.); *Negli* (Mar.).
Habitat.—A very common weed at Adigmet and elsewhere.
Uses.—The root is medicinal.

XII. TAMARICACEÆ.

18. **Tamarix articulata** Vahl., *H.F.B.I.*, i, p. 249.
Vernacular names.—*Faras, Sarru,* (Hind.); *Farwa, Marlei* (Pb.).

Habitat.—Common in river beds on the Marathwari side, viz., in the river bed at Phoolnari in Aurangabad.

Uses.—The bark and galls are used in medicine.

XIII. GUTTIFERÆ.

19. **Calophyllum inophyllum** Linn., *H.F.B.I.*, i, p. 273.
(Alexandrian Laurel.).

Vernacular names.—Sultana Champa, Surpan (Hind.); *Surangi, Undi, nagchampa* (Mar.); *Ponna-chettu* (Tel.).

Habitat.—Concan and Orissa, Ceylon, etc. Cultivated for its flowers.

Uses.—Bark and seeds medicinal.

XIV. TERNSTROEMIACEÆ.

20. **Camellia japonica** Linn., *H.F.B.I.*, i, p. 292.

Habitat.—A cultivated plant.

XV. MALVACEÆ.

21. **Sida acuta** Burm., *H.F.B.I.*, i, p. 323.

Syn.—Sida carpinifolia Linn.

Vernacular names.—Kareta (Hind.); *Jangli-methi* (Bomb.); *Vishaboddee* (Tel.).

Habitat.—Extremely common.

Uses.—Root and leaves are medicinal.

22. **Hibiscus Abelmoschus** Linn., *H.F.B.I.*, i, p. 342.

Vernacular names.—Hab-ul-mishk (Arab.); *Lata-kasturika* (Sans.); *Mushkdana* (Hind.); *Kattuk-kasturi* (Tam.); *Karpura-benda* (Tel.); *Kasturi-bhenda* (Mar.).

Habitat.—It was found in a field at Mulug. I am unable to say whether it is really wild or is an escape from cultivation.

Uses.—Root, leaves and seeds are medicinal.

XVI. STERCULIACEÆ.

23. **Sterculia fœtida** DC., *H.F.B.I.*, i, p. 354.

Vernacular names.—Jangli-badam, Chinee-badam (Hind.); *Pinari* (Tam.); *Gurapu-badam* (Tel.).

Habitat.—Often planted. Flowers: March-May.

Uses.—The seeds are eaten. Leaves, seeds and capsules are medicinal.

24. **Sterculia urens** Roxb., *H.F.B.I.*, i, p. 355.

Vernacular names.—Gulu, Kulu (Hind.); *Pandruka, Karai* (Bomb.); *Kavalee talbsu* (Tel.); *Vellay putali* (Tam.).

Habitat.—Common in most of the Hyderabad forests.

25. **Heritiera littoralis** Dryand., *H.F.B.I.*, i, p. 363.

Vernacular name.—Sundri.

Habitat.—Fruits were collected from the Mulug forest.

26. **Helicteres Isora** Linn., *H.F.B.I.*, i, p. 365.

Vernacular names.—Marorphali, Marosi (Hind.); *Murad Shing* (Mar.); *Known, Kewan* (Bomb.); *Valum-birikai* (Tam.); *Gubadarra* (Tel.).

Habitat.—Wild in many of the forests.

Uses.—A strong fibre is extracted from the bark. Bark, root, and fruits are medicinal.

27. **Kleinhovia Hospita** Linn., *H.F.B.I.*, i, p. 364.

Habitat.—A cultivated tree—Botanic Garden, Osmania University and elsewhere. Flowers: Aug.-Sept.

28. **Pterospermum acerifolium** Willd., *H.F.B.I.*, i, p. 368.

Vernacular names.—Kaniar, Kanak-champa (Hind.); *Matsu Kanda* (Tel.).

Habitat.—Doubtfully indigenous. Often planted in gardens.

Uses.—Leaves, bark and flowers are medicinal.

The following are also cultivated:—

29. **Dombeya angulata.**

30. **Guazuma tomentosa** Kunth., *H.F.B.I.*, i, p. 375.
(Bastard Cedar).

Vernacular names.—Nipal tunth (Beng.); *Rudrakshi* (Bomb.); *Tain-puchli-pattai* (Tam.); *Udrik-patta* (Tel.).

Uses.—It yields a good fibre suitable for rope-making. Bark is medicinal.

XVII. TILIACEÆ.

31. **Grewia hirsuta** Lamk., *H.F.B.I.*, i, p. 391.

Habitat.—Wild. Collection was made from a forest near Kamareddy. Flowers: Aug.-Sept. Fruits in Oct.

32. **Corchorus acutangulus** Lamk., *H.F.B.I.*, i, p. 398.

Habitat.—A common herb round about Adigmet and elsewhere. Flowers in September.

33. **Elæocarpus Ganitrus** Roxb., *H.F.B.I.*, i, p. 400.

Habitat.—Often planted in gardens. (Botanic Garden, Osmania University.)

XVIII. LINACEÆ.

34. **Erythroxylum Coca** Lamk., *Willis's Dict. Flowering Plants and Ferns.*, p. 253.

Habitat.—Cultivated.

Uses.—Cocaine is obtained from leaves.

XIX. RUTACEÆ.

35. **Murraya Kœnigii** Spreng., *H.F.B.I.*, i, p. 503.

Vernacular names.—Harri, Katnim, Karripak (Hind.); *Karu-veppilai* (Tam.); *Kari-vepa-chettu* (Tel.).

Habitat.—Probably wild, but generally cultivated for its leaves.

Uses.—The leaves are used to flavour curries. Bark, root and leaves are medicinal.

XX. SIMARUBACEÆ.

36. **Balanites Roxburghii** Planch., *H.F.B.I.*, i, p. 522.

Vernacular names.—Hingan, hingota (Hind.); *Nanjunda* (Tam.); *Gari* (Tel.).

Habitat.—Common in the Mulug forest.

Uses.—The seeds, bark, leaves and fruit are medicinal.

XXI. OCHNACEÆ.

37. **Ochna squarrosa** Linn., *H.F.B.I.*, i, p. 523.

Vernacular name.—Kanak-champa.

Habitat.—Throughout tropical Asia and Africa. Planted in gardens for its flowers.

XXII. BURSERACEÆ.

38. **Filiceum decipiens** Thwaites., *H.F.B.I.*, i, p. 539..
(Fern-leaved tree.)

Habitat.—Western Ghats, Ceylon etc. It is often cultivated for its foliage.

XXIII. MELIACEÆ.

39. **Chloroxylon swietenia** DC., *H.F.B.I.*, i, p. 569.
(The Indian Satin wood.)

Vernacular names.—Dhoura, Girya (Hind.); *Halda, Billu* (Bomb.); *Halda, Bheria* (Mar.); *Billu-chettu* (Tel.).

Habitat.—Common in many forest reserves.

Uses.—Bark and leaves are medicinal. Wood is of an excellent quality and is used in making furniture.

40. **Soymida febrifuga** A. Juss., *H.F.B.I.*, i, p. 567.

Vernacular names.—Rohan (Hind).; *Ruhin* (Mar.).

Habitat.—Wild in forests on the Telangana side.

Uses.—Bark is medicinal.

41. **Cedrella Toona** Roxb., *H.F.B.I.*, i, p. 568.
(The Toon or Indian Mahogany tree.)
Vernacular names.—*Tun, Mahanim* (Hind.); *Nandi-chettu* (Tel.); *Deodari, Kuruk* (Mar.).
Habitat.—Common in ravines. Flowers in January.
Uses.—The wood is used for furniture. Flowers yield a dye. Bark is medicinal.

XXIV. OLACACEÆ.

42. **Olax scandens** Roxb., *H.F.B.I.*, i, p. 575.
Vernacular names.—*Dheniani* (Hind.); *Harduli* (Mar.).
Habitat.—A common forest tree on the Telangana side.
Uses.—Bark is said to be medicinal.

43. **Cansjera Rheedii** Gymel., *H.F.B.I.*, i, p. 582.
Habitat.—Also a forest tree.

XXV. RHAMNACEÆ.

44. **Ventilago calyculata** Tulasne, *H.F.B.I.*, i, p. 631.
Syn.—*Ventilago madraspatana* Roxb.
Vernacular names.—*Rai ohani* (Hind.); *Sakal yel* (Mar.); *Zerra chiotali* (Tel.).
Habitat.—The material was collected from a valley near the Ellora caves (Aurangabad District).
Uses.—The bark and shoots are medicinal.

45. **Zizyphus Œnoplia** Mill., *H.F.B.I.*, i, p. 634.
Vernacular names.—*Jangli ber, Jhar beri* (Deccan); *Burgi* (Bomb.).
Habitat.—Wild throughout the dominions in scrub-jungle.

46. **Zizyphus xylopyrus** Willd., *H.F.B.I.*, i, p. 634.
Vernacular names.—Locally the name *Jangli ber* is used indiscriminately for all the wild species of Zizyphus; *Guti* (Bomb.).
Habitat.—Common in many dry places.

XXVI. AMPELIDACEÆ.

(*Vitaceae*).

47. **Vitis quadrangularis** Wall, *H.F.B.I.*, i, p. 645.
Syn.—*Cissus quadrangularis* Linn.
Vernacular names.—*Harshankar, Kandawel, Kharbuti* (Hind.); *Pirandal* (Tam.); *Nulle rotigeh* (Tel.).
Habtiat.—Very common.
Uses.—Young stems are eaten in curries. Stem and leaves are medicinal.

48. **Vitis pallida** W. & A., *H.F.B.I.*, i, p. 647.
Habitat.—Rather rare.

49. **Vitis lanata** Roxb., *H.F.B.I.*, i, p. 651.
Syn.—*Cissus vitiginea* Roxb.
Habitat.—Wild.

50. **Leea aspera** Wall., *H.F.B.I.*, i, p. 665.
Habitat.—Wild in the Ghats at Khuldabad (Aurangabad District).

XXVII. SAPINDACEÆ.

51. **Cardiospermum Halicacabum** Linn., *H.F.B.I.*, i, p. 670.
(Heart-pea or Balloon-vine).
Vernacular names.—*Lata phatkari, noaphutki, kapalphodi, khibjal* (Bomb.); *Muda-cottan* (Tam.); *Kanakaia, budha-kakara* (Tel.).
Habitat.—Common in hedges and fields.
Uses.—Roots, leaves and seeds are used in medicine.

52. **Nephelium Litchi** Camb., *H.F.B.I.*, i, p. 687.
Vernacular names.—*Litchi, Lichi.*
Habitat.—A native of S. China, occasionally cultivated in Hyderabad. (It is growing in the Botanic Garden, Osmania University.)

Uses.—The leaves are said to be used in China as a remedy for the bites of animals.

XXVIII. LEGUMINOSÆ.

53. **Crotalaria ramosissima** Roxb., *H.F.B.I.*, ii, p. 80.
Habitat.—The material was collected from a field in Mulug.

54. **Desmodium pulchellum** Benth., *H.F.B.I.*, ii, p.162.
Habitat.—Very common in forests, viz., near Kamareddy towards Nizam Sagar.

55. **Clitoria Ternatea** Linn., *H.F.B.I.*, ii, p. 208.
Vernacular names.—Asphota (Sans.); *Kalizer, Visnukranti* (Hind.); *Gokaran* (Bomb.); *Kakkanam-kodi* (Tam.); *Dintana, tella-dintana* (Tel.).
Habitat.—Common in hedges and fields.
Uses.—The root, leaves and seeds are medicinal.

56. **Pterocarpus Marsupium** Roxb., *H.F.B.I.*, ii, p. 239.
Vernacular names.—Bija (Hind.); *Bibla, asan* (Bomb.); *Vengai* (Tam.); *Peddagi* (Tel.).
Habitat.—Fruits were collected from the Mulug forest.
Uses.—Gum and bark are medicinal.

57. **Cæsalpinia coriaria** Willd., *Cooke. Fl. Bomb. Pres.* Pt. iii, p. 413. (The American Sumach.)
Habitat.—Native of S. America which is often cultivated.

58. **Peltophorum ferrugineum** Benth., *H.F.B.I.*, ii, p. 257.
Habitat.—A cultivated road-side tree.

59. **Cassia grandis** Linn., *Cooke. Fl. Bomb. Pres.*, Pt. III, p. 426.
Habitat.—Commonly planted.

60. **Cassia nodosa** Ham., *H.F.B.I.*, ii, p. 286.
Habitat.—Also a cultivated species.

61. **Xylia dolabriformis** Benth., *H.F.B.I.*, ii, p. 286.
Syn.—Inga xylocarpa DC.
Vernacular names.—Jambhai, Yerul.
Habitat.—Wild in the forests on the Telangana side.
Uses.—The wood which is hard and durable is useful for making poles and rafters.

62. **Adenanthera pavonina** Linn., *H.F.B.I.*, ii, p. 287.
Vernacular names.—Ronta-chandan, ranjan (Hind.); *Thorla-gunj* (Bomb.); *Manjadi* (Tam.); *Bandi-gurvina* (Tel.).
Uses.—Leaves and seeds are medicinal.
Habitat.—Often planted.

63. **Dicrostachys cinerea** W. & A., *H.F.B.I.*, ii, p. 288.
Syn.—Mimosa cinerea Linn.
Vernacular names.—Vurtuli (Hind.); *Segumkati* (Mar.); *Yeltu, Veturu* (Tel.); *Vadatalla* (Tam).
Habitat.—Wild in many of the Hyderabad forests.
Uses.—Young shoots are said to be medicinal.

XXIX. ROSACEÆ.

The following are cultivated :—

64. **Eriobotrya japonica** Lindl., *H.F.B.I.*, ii, p. 372. (Loquat.)

65. **Pyrus communis** Linn., *H.F.B.I.*, ii, p. 374. (Pear.)

66. **Pyrus malus** Linn., *H.F.B.I.*, ii, p. 373. (Apple.)

67. **Prunus amygdalus** Baill., *H.F.B.I.*, ii, p. 313. (Almond.)

68. **Prunus persica** Benth., *H.F.B.I.*, ii, p. 313. (Peach.)

XXX. CRASSULACEÆ.

The following are cultivated :—

69. **Kalanchoe spathulata** DC., *H.F.B.I.*, ii, p. 414.
Vernacular names.—Tatara, Haiza-ka-patta (Hind.).
Uses.—Leaves are medicinal.

70. **Kalanchoe laciniata** DC., *H.F.B.I.*, ii, p. 415.
Vernacular names.—Tukhmhyat, Parna-bij (Bomb.); *Mala-kullie* (Tam.).
Uses.—Leaves are medicinal.

XXXI. COMBRETACEÆ.

71. **Terminalia Chebula** Retz., *H.F.B.I.*, ii, p. 446.
Vernacular names.—Harara (Hind.); *Kadukai-maram* (Tam.); *Karakaia* (Tel.).
Habitat.—Very common in the forests on the Telangana side.
Uses.—Fruits are medicinal.

72. **Anogeissus latifolia** Wall., *H.F.B.I.*, ii, p. 450.
Vernacular names.—Dhaoya (Hind.); *Dhavada, Dabria* (Bomb.); *Vallai-naga* (Tam.).
Habitat.—Very common in dry forests.
Uses.—The wood is strong and may be utilised in making several useful articles. A useful gum is also obtained.

XXXII. MYRTACEÆ.

The following are cultivated :—

73. **Eugenia Michelii** Lamk., *Cooke. Fl. Bomb. Pres.* Pt. III, p. 495.
(Brazil Cherry.)
Habitat.—Native of South America.

74. **Callistemon rigidus** (bottle-brush).

75. **Callistemon lilacinus.**

76. **Callistemon lanceolatus.**

77. **Eucalyptus citriodora.**
(Lemon-scented Eucalyptus).

XXXIII. MELASTOMACEÆ.

78. **Memecylon edule** Roxb., *H.F.B.I.*, ii, p. 563.
Vernacular names.—Limba (Mar.); *Alli chettu* (Tel.); *Cashamarum* (Tam.).
Habitat.—Eastern Peninsula and Ceylon, very common at Mahabaleshwar. Cultivated as an ornamental tree.
Uses.—The leaves and root are medicinal.

79. **Dalenia speciosa.**
Habitat.—Also cultivated.

XXXIV. ONAGRACEÆ.

80. **Jussiæa repens** Linn., *H.F.B.I.*, ii, p. 587.
Habitat.—Common on the margins of tanks and in rice-fields.

81. **Trapa bispinosa** Roxb., *H.F.B.I.*, ii, p. 590.
Syn.—Trapa quadrispinosa Wall.
(Water chestnut).
Vernacular names.—Singhara (Hind.); *Parigadda* (Tel.); *Shingada* (Mar.); *Shingara* (Tam.).
Habitat.—Commonly cultivated in tanks.
Uses.—Fruit is eaten. It is also medicinal.

XXXV. CUCURBITACEÆ.

82. **Mukia scabrella** Arn., *H.F.B.I.*, ii, p. 623.
Syn.—Melothria maderaspatana Cogn.

Vernacular names.—*Bilari, Gwala-kakri* (Hind.); *Musu-musuk-kai* (Tam.); *Kutaru-budama* (Tel.).

Habitat.—Common in hedges and fields. Flowers in July.

Uses.—Root, leaves and seeds are medicinal.

XXXVI. CACTACEÆ.

The following are cultivated:—

83. **Trichocereus candicans** Gill.

84. **Echinopsis aurea** Rose.

85. **Echinocereus sp.**

86. **Echinocactus multiflorus** Hook.

87. **Arocarpus retusus** Scheidw.

88. **Epiphyllum sp.**
(Phyllocactus.)

XXXVII. ARALIACEÆ.

89. **Hedera Helix** Linn., *H.F.B.I.*, ii, p. 739.
(The Ivy.)

Vernacular names.—*Dudela* (Nepal); *Lablab* (Behar).

Habitat.—Throughout the Himalayas. Cultivated and thrives well.

Uses.—Leaves and fruits are medicinal.

XXXVIII. CORNACEÆ.

90. **Alangium Lamarckii** Thwaites, *H.F.B.I.*, ii, p. 741.

Vernacular names.—*Akola, thaila ankul* (Hind.); *Akar-kanta* (Beng.); *Alangi, Azhinji* (Tam.).

Habitat.—Very common in the forest at Mulug.

Uses.—Root, root-bark and fruits are medicinal.

XXXIX. CAPRIFOLIACEÆ.

91. **Lonicera Periclymenum** Linn, *Willis's Dict. Flowering Plants and Ferns.*
(Honey-suckle or woodbine.)

Habitat.—Cultivated.

XL. RUBIACEÆ.

92. **Hymenodictyon excelsum** Wall., *H.F.B.I.*, iii, p. 36.

Vernacular names.—*Bhaulan* (Hind.); *Kalakurwah, Bhorsal* (Bomb.); *Chetippa, Bandara* (Tel.); *Bhoursal* (Mar.); *Sagapu* (Tam.).

Habitat.—I mentioned in *J.A.S.B.*, Sc., I, p. 1, 1935 that this tree was recorded by Paztridge. Now I have to remark that I have found it very common in the Telangana forests.

Uses.—Bark is medicinal. Wood is durable and close-grained, and is employed in making agricultural implements.

93. **Wendlandia exserta** DC., *H.F.B.I.*, iii, p. 66.

Habitat.—It is found in some of the dry forests, but it is not so common as the preceding plant.

94. **Oldenlandia umbellata** Linn., *H.F.B.I.*, iii, p. 66.

Vernacular names.—*Chirval* (Hind.); *Cherivells, Chiruveru* (Tel.); *Imbural* (Tam.).

Habitat.—Extremely common in the vicinity of the Osmania University. Prefers rather hard and dry soil.

Uses.—Root and leaves are medicinal.

95. **Morinda citrifolia** Linn., *H.F.B.I.*, iii, p. 155.

Vernacular names.—*Al* (Hind.); *Al, Bartondi* (Bomb.); *Molagha, Maddichettu* (Tel.); *Noona-maram* (Tam.).

Habitat.—It is pretty common, but I am unable to say whether or not it is really wild.

Uses.—The roots furnish a valuable red dye. They are also medicinal.

96. **Hydroflax maritima** Linn., *H.F.B.I.*, iii, p. 199.
Habitat.—Extremely common at Adigmet. It may be classed as a sand-binder.

97. **Spermacoce hispida** Linn., *H.F.B.I.*, iii, p. 200.
Syn.—*Borreria hispida* K. Sch.
Vernacular names.—*Madana ghanti* (Hind. and Tel.); *Nuttee-choorie* (Tam.).
Habitat.—Same as that of the preceding species.
The following are commonly cultivated :—

98. **Mussænda frondosa** Linn., *H.F.B.I.*, iii, p. 89.
Vernacular names.—*Asari* (Nepal); *Sarvas, Bhuta-kesa* (Bomb.); *Shivardole* (Mar.); *Vellaellay* (Tam.).
Uses.—Root and leaves are medicinal.

99. **Nauclea cadamba** Linn.

100. **Hamelia patens** Jacquin.

101. **Cinchona Catlisaya** Wedd.

102. **Cinchona Ledgeriana** Moens.

103. **Cinchona officinalis** Linn.

XLI. COMPOSITÆ.

104. **Grangea maderaspatana** Poir, *H.F.B.I.*, iii, p.247.
Syn.—*Artemisia maderaspatana* Roxb.
Vernacular names.—*Mustary* (Hind.); *Afsanteen* (Arab.); *Baranjasif kowhi* (Pers.); *Namuti* (Beng.); *Mashi pattiri* (Tam.); *Savi* (Tel.).
Habitat.—A very common 'mat plant', spreading flat like a spider's web.
Uses.—Leaves are medicinal.

105. **Cæsulia axillaris** Roxb., *H.F.B.I.*, iii, p. 291.
Habitat.—A common herb.

106. **Vicoa auriculata** Cass., *H.F.B.I.*, iii, p. 297.
Syn.—*Vicoa indica* DC.
Habitat.—A common herb found in dry situations.

107. **Pulicaria Wightiana** Clarke, *H.F.B.I.*, iii, p. 298.
Syn.—*Callistephus Wightianus* DC.
Habitat.—Very common round about Adigmet and at other places.

108. **Xanthium strumarium** Linn., *H.F.B.I.*, iii, p. 303.
Vernacular names.—*Chota-gokhru* (Hind.); *Bun-okra* (Beng.); *Shan-keshvara, Dhupa* (Bomb.); *Marlumulta* (Tam.); *Veritel-nep* (Tel.).
Habitat.—Common in the compounds of houses.
Uses.—The whole plant is said to be medicinal.

109. **Eclipta alba** Hassk., *H.F.B.I.*, iii, p. 304.
Syn.—*Eclipta erecta* Linn.
Vernacular names.—*Kesaraja* (Sans.); *Maka, Bhangra* (Bomb.); *Kaikeshi* (Tam.); *Goontagelinjeroo* (Tel.).
Habitat.—Pretty common all over.
Uses.—Leaves and juice are described as medicinal.

110. **Glossocardia linearifolia,** *H.F.B.I.*, iii, p. 308.
Vernacular names.—*Parapalavum* (Tel.); *Pitpapda, Phattarsuva* (Bomb.).
Habitat.—Very common.
Uses.—The plant is described as medicinal.

111. **Emilia sonchifolia** DC., *H.F.B.I.*, iii, p. 336.
Vernacular name.—*Sadhi-mandi* (Bomb.).
Habitat.—A common herb all over.
Uses.—Medicinal.

112. **Echinops echinatus** DC., *H.F.B.I.*, iii, p. 358.
Vernacular names.—*Utali* (Sans.); *Utkatara* (Hind.).
Habitat.—Abundant throughout.
Uses.—Medicinal.

113. **Carthamus tinctorius** Linn., *H.F.B.I.*, iii, p. 386.
(The Safflower.)

Vernacular names.—*Karar, Kusum* (Hind.); *Kusumbha* (Sans.); *Kardai, kurdi* (Mar.); *Sendurgam, Kushumbavittu-lu* (Tel.).

Habitat.—Cultivated.

Uses.—The oil from the seeds is used in Hyderabad to adulterate sesamum-oil. Seeds, oil and flowers are medicinal.

The following are commonly cultivated:—

114. **Spilanthes Acmella** Linn., *H.F.B.I.*, iii, p. 307.

Habitat.—Although found throughout India I have not met with in a wild state so far.

Uses.—The flower-heads when chewed have a hot burning taste and cause profuse salivation. Medicinal.

115. **Aster Amellus** Linn.
(The Michaelmas Daisy.)

116. **Callistephus hortensis** Cass.
(German or Chinese Aster.)

117. **Zinnia elegans** Jacq.

118. **Helianthus annus** Linn.
(The common Sun-flower).

119. **Coreopsis tinctoria** Nutt.

120. **Dahlia variabilis** Desf.

121. **Cosmos bipinnatus** Cav.

122. **Tagetes erecta** Linn.

123. **Gaillardia aristata** Pursh.

124. **Calendula officinalis** Linn.
(The common Marigold).

125. **Polymnia grandis.**

126. **Lactuca Scariola** Linn.
(The garden lettuce).

127. **Artemisia argentea** Buch.

XLII. ERICACEÆ.

The following are cultivated:—

128. **Rhododendron arboreum** Sm., *H.F.B.I.*, iii, p. 465.

Uses.—Medicinal.

129. **Rhododendron Aucklandii.**

XLIII. PLUMBAGINACEÆ.

130. **Plumbago zeylanica** Linn., *H.F.B.I.*, iii, p. 480.

Vernacular names.—*Agni-shikha, Chitraka* (Sans.); *Chitra* (Hind.); *Shitaraj* (Arab.); *Shitaruk* (Pers.); *Chitu* (Beng.); *Tella-chitra* (Tel.); *Venchittira* (Tam.); *Chitrak* (Bomb.).

Habitat.—Wild.

Uses.—Root is considered medicinal.

131. **Plumbago capensis** Thunb., *Cooke. Fl. Bomb. Pres.*, Pt. II, 1, p. 78.

Habitat.—Cultivated for its profuse blue flowers.

XLIV. EBENACEÆ.

132. **Maba buxifolia** Pers., *H.F.B.I.*, iii, p. 560.

Habitat.—Wild in the Mulug forest.

133. **Diospyros Chloroxylon** Roxb., *H.F.B.I.*, iii, p. 560.

Habitat.—A common forest tree.

134. **Diospyros tomentosa** Roxb., *H.F.B.I.*, iii, p. 564.

Habitat.—Same as that of the preceding species.

135. **Diospyros kaki** Linn., *H.F.B.I.*, iii, p.555.
Habitat.—Khasia Mountains. Cultivated.

XLV. OLEACEÆ.

136. **Jasminum Roxburghianum** Wall, *H.F.B.I.*, iii, p. 595.
(Perhaps a variety of *Jasminum arborescens* Roxb.)
Vernacaular name.—Jangli Chambeli (Local).
Habitat.—Common in scrub jungle and forests.

137. **Syringa vulgaris** Linn.
(The Lilac).
Habitat.—Cultivated.

XLVI. APOCYNACEÆ.

138. **Vinca pusilla** Murr., *H.F.B.I.*, iii, p. 640.
Syn.—Lochnera pusilla K. Sch.
Habitat.—A common weed in the beginning of the rainy season.

139. **Vallaris Heynei** Spreng., *H.F.B.I.*, iii, p. 650.
Syn.—Echites dichotoma Roxb.
Vernacular names.—Ramsar (Hind.); *pala malle tivva* (Tel.); *Bhadravalli* (Sans.).
Habitat.—Although found in abundance in many parts of Hyderabad I doubt if it is really wild here.
Uses.—The milky juice is medicinal.

140. **Tabernæmontana coronaria** Br., *H.F.B.I.*, iii, p. 646.
Vernacular names.—Tagara (Sans.); *Chandni, Taggar* (Hind.); *Nandi-vardana* (Tel.).
Habitat.—Not indigenous, but very commonly cultivated for its white and fragrant flowers.
The following are occasionally grown in gardens :—

141. **Roupellia grata** Wall, *Cooke. Fl. Bomb. Pres.,* II, 1, p. 143.
A climber with pale rose-coloured flowers.

142. **Strophanthus Wallichii** A. DC., *Cooke, Fl. Bomb. Pres.*, II, 1, p. 143.
A climber with red and white flowers.

XLVII. ASCLEPIADACEÆ.

143. **Sarcostemma brevistigma.** W. & A., *H.F.B.I.*, iv, p. 26.
Syn.—Asclepias acida Roxb.
Vernacular names.—Somalata (Hind.); *Soma* (Bomb.); *Tigatshumoodoo* (Tel); *Ran sher* (Mar.).
Habitat.—A wild xerophytic plant common round about Adigmet.
Uses.—Water passed through a bundle of this plant and a bag of salt seems to extirpate white ants from a field watered by it (Kirtikar).

144. **Dregea volubilis** Benth., *H.F.B.I.*, iv, p. 46.
Syn.—Asclepias volubilis Linn.
Vernacular names.—Nak-chhikni (Hind.); *Tita-kunga* (Beng.); *Ambri* (Mar.); *Kodie-palay* (Tam.); *Dudi-palla* (Tel).
Habitat.—A wild climber in most forests on the Telangana side.
Uses.—Roots, leaves and tender stalks are medicinal.

145. **Leptadenia reticulata** W. & A., *H.F.B.I.*, iv, p. 63.
Habitat.—A common twiner with greenish-yellow flowers.

146. **Ceropegia juncea** Roxb., *H.F.B.I.*, iv, p. 68.
Vernacular name.—Kanvel (Mar.).
Habitat.—Very common. The specimens were obtained from Amir Pet.
The following are cultivated :—
(Both are growing in the Botanic Garden, Osmania University.)

147. **Pergularia minor** Andr., *H.F.B.I.*, iv, p. 38.
Syn.—Pergularia odoratissima W.
Flowers in April.

148. **Stephanotis floribunda** Brongn, *Cooke. Fl. Bomb. Pres.*, ii, 1, p. 180.

XLVIII. LOGANIACEÆ.

149. **Buddleia asiatica** Lour., *H.F.B.I.*, iv, p. 82.
Habitat.—Although very common throughout India it is not found wild in *Hyderabad*, but is commonly grown in gardens.

XLIX. GENTIANACEÆ.

150. **Enicostema littorale** Blume, *H.F.B.I.*, iv, p. 101.
Vernacular names.—*Chota kirayata* (Hind. & Bomb.); *Kadavinayi* (Mar.); *Vellurugu* (Tam.); *Nela-gulamidi* (Tel.).
Habitat.—Very common in *morum* soil and dry places at Adigmet and elsewhere.
Uses.—Medicinal.

151. **Limnanthemum cristatum** Grieseb, *H.F.B.I.*, iv, p. 131.
Habitat.—Extremely common in ponds and canals. Flowers in April.

152. **Limnanthemum indicum** Thwaites, *H.F.B.I.*, iv, p. 131.
Habitat.—It is not so common as the preceding species.

L. POLEMONIACEÆ.

The following is commonly cultivated :—

153. **Phlox Drummondii.**

LI. BORAGINACEÆ.

154. **Heliotropium paniculatum** R. Br., *H.F.B.I.* iv, p. 151.
Habitat.—Very common at Adigmet, growing in patches. Flowers : April.

155. **Heliotropium indicum** Linn., *H.F.B.I.*, iv, p. 152.
Syn.—*Tiaridium indicum* Lehm.
Vernacular name.—*Bhurundi.*
Habitat.—A common weed in waste places.—Flowers—Oct.-Dec.

156. **Heliotropium zeylanicum** Lamk., *H.F.B.I.*, iv, p. 148.
Habitat.—Same as that of the preceding species.
The following are cultivated :—

157. **Cordia Sebestina** Linn., *Cooke. Fl. Bomb. Pres.*, II, 1, p. 202.

158. **Heliotropium peruvianum** Linn., *Cooke. Fl. Bomb. Pres.*, II, 1, p. 213.

159. **Borago officinale.**

LII. CONVOLVULACEÆ.

160. **Ipomœa Quamoclit** Linn., *H.F.B.I.*, iv, p. 199.
Vernacular Names.—*Vishnukrant* (Mar.); *Kamlata* (Hind.); *Ganesh-vel, Sita che kesh* (Bomb.).
Habitat.—Native of tropical America, commonly grown in gardens throughout India.
Uses.—Leaves are said to be medicinal.

161. **Ipomœa pes-tigridis** Linn., *H.F.B.I.*, iv, p. 204.
Habitat.—Common in hedges.
Uses.—Medicinal.

162. **Ipomœa aquatica** Forsk., *H.F.B.I.*, iv, p. 210.
Vernacular names.—*Kalambi* (Sans.); *Nari, Nali* (Pb.); *Nalichibhaji* (Bomb.); *Koilangu* (Tam.); *Tuti-kura* (Tel.).
Habitat.—Wild, growing in shallow ponds and marshy ground.
Uses.—The juice is described as medicinal.

163. **Ipomœa biloba** Forsk., *H.F.B.I.*, iv, p. 212.
Syn.—*Convolvulus Pes-caprae* Linn.
Vernacular names.—*Dopti-lata* (Hind.); *Marjadvel* (Bomb.); *Balabandi tige* (Tel.).
Habitat.—Found in dry sandy or *morum* soil.
Uses.—Root and leaves are medicinal.

164. **Porana paniculata** Roxb., *H.F.B.I.*, iv, p. 222.
Habitat.—It is wild in many parts of India, and is commonly grown in Hyderabad, and is also found as an escape.

The following are commonly cultivated :—

165. **Jacquemontia caerulea** Choisy, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 236.
Habitat.—Native of South America.

166. **Ipomœa Leari** Purt., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 251.
Habitat.—Native of tropical America, a favourite ornament of verandahs. The large blue flowers become reddish on fading.

LIII. SOLANACEÆ.

167. **Solanum indicum** Linn., *H.F.B.I.*, iv, p. 234.
Vernacular names.—*Barhanta* (Hind.); *Mulli* (Tam.); *Kuk-machi* (Tel.); *Dorli, Ringani* (Bomb.).
Habitat.—A common undershrub.
Uses.—The root and leaves are medicinal.

168. **Physalis minima** Linn., *H.F.B.I.*, iv, p. 238.
Vernacular names.—*Kupanti* (Tel.); *Chirboti, Ran-popati* (Bomb.).
Habitat.—A common weed in fields and hedges.
Uses.—Medicinal.

The following are commonly cultivated :—

169. **Solanum macrophyllum** Hort., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p, 269.
Habitat.—Native of Mexico with large leaves and showy blue flowers which turn white on fading.

170. **Physalis peruviana** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 270.
(Cape Goose-berry).
Habitat.—Native of Tropical America.

171. **Cyphomandra betacea** Sendt., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 275.
Cooke mentions on the authority of Woodrow that it has been unable to resist the south-west monsoon in the Deccan, but in the Botanic Garden, Osmania University, it seems to have adapted itself.

172. **Cestrum nocturnum.**
Flowers greenish-yellow, very fragrant.

173. **Petunia nyctaginiflora** Juss., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 276.

174. **Petunia violacea** Lindl., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 276.
Both are natives of the Argentine. Several varieties are grown in gardens.

LIV. SCROPHULARIACEÆ.

175. **Herpestis Monniera** H. B. & K., *H.F.B.I.*, iv, p. 272.
Syn.—*Moniera cuneifolia* Michaux.
Vernacular names.—*Brahmi, jal-nim* (Hind.); *Beami nirpirimie* (Tam.) *Sembrani-chettu* (Tel.).
Habitat.—Common in damp places, particularly on untrodden portions of lawns. Flowers—Feb.-April.
Uses.—Root, stalks and leaves are medicinal.

176. **Vandellia crustacea** Benth., *H.F.B.I.*, iv, p. 279.
Habitat.—Quite common. Flowers in August.

177. **Striga orobanchioides** Benth., *H.F.B.I.*, iv, p. 299.
Habitat—A common root-parasite. It was found on *Lepidagathis cristata.* It dries black. Flowers—October-November.

178. **Sopubia delphinifolia** G. Don., *H.F.B.I.*, iv, p. 302.
Vernacular name.—*Dudhali* (Bomb.).
Habitat.—Very common in cultivated fields. Flowers at the close of the rains—August-October.

Uses.—The juice of the plant is said to be medicinal.

The following are cultivated :—

179. **Russelia juncea** Zucc., *Cooke. Fl. Bomb. Pres.*, Vol. II. Pt. II, p. 310. A Mexican plant grown in gardens for its handsome showy scarlet flowers.

LV. GESNERIACEÆ.

The following are grown in gardens :—

180. **Achimines hirsuta** DC., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 325. A native of Brazil. Several varieties are grown.

Gloxinia maculata L'Herit, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 325.

LVI. BIGNONIACEÆ.

181. **Dolichandrone falcata** Seem., *H.F.B.I.*, iv, p. 382.

Vernacular names.—*Mersinge* (Bomb.); *Mersingi* (Mar.); *Kodatathie* (Tam.); *Udda, Wodi* (Tel.).

Habitat.—Rather rare.

Uses.—Fruit and bark are said to be medicinal.

182. **Stereospermum chelonoides** DC., *H.F.B.I.*, iv, p. 382.

Vernacular names.—*Padri, Parral* (Hind.); *Dharmar* (Beng.); *Padal* (Bomb.); *Kirsel, padhri* (Mar.); *Padri, Appu* (Tam.); *Moka-yapa, Pisul* (Tel.).

Habitat.—Common in moist forests.

Uses.—Roots, leaves and flowers are medicinal.

The following are commonly cultivated :—

183. **Tecoma undulata** D. Don., *H.F.B.I.*, iv, p. 378.

Syn.—*Tecomella undulata* Seem.

184. **Tecomaria capensis** Spach., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 335.

Syn.—*Tecoma capensis* Lindl.

185. **Parmentiera cereifera** Seem., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 336.

(Candle tree of Panama).

186. **Jacaranda mimosæolia** D. Don.

LVII. PEDALIACEÆ.

187. **Sesamum laciniatum** Klein., *H.F.B.I.*, iv, p. 387.

Habitat.—It was in abundance at Adigmet in 1935, but owing to grazing and clearance of weeds it has not been seen last season, that is, at the close of rains about September. It has dark purple flowers.

LVIII. ACANTHACEÆ.

188. **Ruellia prostrata** Lamk., *H.F.B.I.*, iv, p. 411.

Habitat.—A common weed. Flowers after the rains.

Uses.—Leaves are medicinal.

189. **Blepharis molluginifolia** Pers., *H.F.B.I.*, iv, p. 479.

Habitat.—Wild. The material was collected from a field in Mulug.

190. **Barleria Prionitis** Linn., *H.F.B.I.*, iv, p. 482.

Vernacular names.—*Karuntaka* (Sans.); *Katsareya* (Hind.); *Korhanti, Vijradanti* (Bomb.); *Piwala koranta* (Mar.); *Varamulti* (Tam.); *Muli-goranta* (Tel.).

Habitat.—Common throughout the Dominions, also often planted as a hedge. Flowers, October-January.

Uses.—Medicinal.

191. **Barleria cristata** Linn., *H.F.B.I.*, iv, p. 488.

Vernacular names.—*Jhinti* (Sans.); *Thanti, Sada-jati; Gokran* (Bomb.); *Bansa siyah* (Pb.).

Habitat.—A common plant with purple-blue or white flowers.

Uses.—Root, leaves and seeds are said to be medicinal.

192. **Andrographis echinoides** Nees., *H.F.B.I.*, iv, p. 505.

Habitat.—Wild, very common in the vicinity of Adigmet and elsewhere.

Uses.—Medicinal.

193. **Adhatoda vasica** Nees., *H.F.B.I.*, iv, p. 540.

Syn.—*Justicia Adhatoda* Linn.

Vernacular names.—*Arusak, Vasa etc.* (Sans.); *Arusha* (Hind.); *Bakas, vasaka* (Beng.); *Bansa* (Pers.); *Adhadode* (Tam.); *Adasara* (Tel.).

Habitat.—A common hedge plant about villages near Aurangabad and elsewhere.

Uses.—A yellow dye is obtained from the leaves. The leaves and root are medicinal.

194. **Rungia repens** Nees., *H.F.B.I.*, iv, p. 548.

Syn.—*Justicia repens* Linn.

Vernacular names.—*Kodaga saleh* (Tam.); *Ghatipitpada* (Bomb.).

Habitat.—An extremely common weed. Flowers, October-January.

Uses.—Medicinal.

195. **Justicia diffusa** Willd., *H.F.B.I.*, iv, p. 538.

Syn.—*Rostellularia diffusa* Nees.

Habitat.—As common as the preceding species.

The following are garden favourites :—

196. **Meyenia erecta** Benth., *Cooke. Fl Bomb. Pres.*, Vol. II, Pt. II, p. 343.

Syn.—*Thunbergia erecta* T. Anders.

197. **Eranthemum bicolor** Schrank, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 390.

(Several varieties are grown.)

198. **Graptophyllum hortense** Nees., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 416.

Uses.—Leaves are medicinal.

199. **Crossandra undulæfolia** Salisb., *H.F.B.I.*, iv, p. 492.

200. **Sanchezia nobilis** Hook, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 416.

LIX. VERBENACEÆ.

201. **Lippia nodiflora** Rich., *H.F.B.I.*, iv, p. 563.

Vernacular names.—*Vashira* (Sans.); *Bhin-okra* (Hind.); *Ratolia* (Bomb.); *Podutabi* (Tam.); *Bokenaku* (Tel.).

Habitat.—Very common on untrodden portions of lawns and grassy places. Flowers: February-April. Cooke mentions that they are found more or less all the year which is true, but in Hyderabad they are seen in abundance during the months of February and March.

Uses.—Medicinal.

202. **Stachytarpheta indica** Vahl., *H.F.B.I.*, iv, p. 564.

Habitat.—A common herb. It is so common that it can easily be taken as indigenous, although, perhaps, it is not.

203. **Premna integrifolia** Linn., *H.F.B.I.*, iv, p. 574.

Syn.—*Premna serratifolia* Linn.

Vernacular names.—*Ganikarika, Agnimantha* (Sans.); *Agetha, arni* (Hind.); *Ganiari* (Beng.); *Erumaimullai, Munnay* (Tam.); *Pinuanelli* (Tel.); *Chamari* (Mar.).

Habitat.—I am doubtful about its being wild here, although it is very common near the sea. Flowers in July.

Uses.—Medicinal.

The following are commonly cultivated :—

204 **Verbena officinalis** Linn., *H.F.B.I.*, iv, p. 656.

Uses.—Medicinal.

205. **Verbena incisa** Hook., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 436.

206. **Clerodendron inerme** Gaertn., *H.F.B.I.*, iv, p. 589.

Uses.—Medicinal.

207. **Aloysia citriodora** Orteg., *Cooke. Fl. Bomb. Pres.*, vol. II, Pt, III, p. 436.
Syn.—Lippia citriodora H. B. (Lemon-scented Aloysia or Verbena).

208. **Petrea volubilis** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 436

209. **Citharexylum subserratum** Sw., *Cooke. Fl. Bomb. Pres.* Vol. II, Pt. III, p. 437.
Vernacular name.—Din-ka-Raja (local).

LX. LABIATÆ.

210. **Coleus aromaticus** Benth., *H.F.B.I.*, iv, p. 625.
Vernacular names.—Pashana Chedi (Sans.) *Pathar chur* (Hind. and Bomb.); *Karpura valli* (Tel.); *Panacha onva* (Mar.).
Habitat.—Commonly cultivated.
Uses.—Medicinal.

211. **Anisochilus carnosus** Wall., *H.F.B.I.*, iv, p. 627.
Vernacular names.—Ajapada, induparni (Sans.); *Panjiri-ka-pat* (Hind.); *Ajvan-ka-patta* (local); *Karpuravalli* (Tel.); *Panajiren* (Mar.).
Habitat.—Wild in many parts of India. Cultivated.
Uses.—Leaves and oil are medicinal.

212. **Leucas diffusa** Benth., *H.F.B.I.*, iv, p. 689.
Habitat.—Very wild in gravelly soil at Adigmet and elsewhere.

213. **Leucas aspera** Spreng., *H.F.B.I.*, iv, p. 690.
Vernacular names.—Tamba (Bomb.); *Tunbai-chedi* (Tam.); *Thumma-chettu* (Tel.).
Habitat.—The same as that of the preceding species.
Uses.—Leaves are said to be medicinal.

214. **Leonotis nepetæfolia** Br., *H.F.B.I.*, iv, p. 691.
Vernacular names.—Dipmal, Ekri (Mar.); *Rana bheri* (Tel.).
Habitat.—Commonly found, but doubtfully indigenous.
Uses.—Flowers are considered medicinal.

The following are commonly cultivated:—

215. **Lavendula vera** D.C., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 453.
(True Lavender).
Cooke is right in remarking that it sometimes drags out a sickly existence as a pot plant. I have to add that it often does so in Hyderabad. Economically and medicinally important.

216. **Salvia involucrata** Cav., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 475.

217. **Origanum Marjorana** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 475.
(The Marjorum).
Vernacular names.—Murva (Hind.); *Maroo* (Tam.).
Uses.—An essential oil is distilled from the leaves and is used as a perfume. Seeds, leaves and oil are medicinal.

LXI. AMARANTACEÆ.

218. **Celosia cristata** Linn., *H.F.B.I.*, iv, p. 715.
(Cock's comb).
Vernacular names.—Murgha-ka-phul, Pila-murgha, Lal-murgha (Hind.).
Habitat.—Cultivated.
Uses.—Medicinal.

219. **Allmania nodiflora** Br., *H.F.B.I.*, iv, p. 716
Habitat.—A common weed. It is very variable, and hence there are many varieties.

220. **Amarantus viridis** Linn., *H.F.B.I.*, iv, p. 720.
Habitat.—A common weed in gardens and waste places.

221. **Amarantus polygamus** Linn., *H.F.B.I.*, iv, p 721.
Syn.—Amarantus polygonoides Willd.
Habitat.—Also a common weed.

The following species of Amarantus are cultivated :—

222. **Amarantus caudatus** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 491.
(Love-lies-bleeding).

223. **Amarantus hypochondriacus** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 491.
(The Prince's Feather).

244. **Nothosærua brachiata** Wight., *H.F.B.I.*, iv, p. 726.
Habitat—Pretty common.

225. **Aerua lanata** Juss., *H.F.B.I.*, iv, p. 728.
Syn.—Achyranthus lanata Linn.
Vernacular names.—Kapur-madhura (Mar.); *Sirru-pulay vayr* (Tam.); *Pindie-conda* (Tel.).
Habitat.—Quite a common weed. Flowers: September-November.
Uses.—Medicinal.

226. **Aerua Monsonia** Mart., *H.F.B.I.*, iv, p. 728.
Syn.—Achyranthus Monsonia Pers.
Habitat.—Very common. Flowers: October-January.

227. **Alternanthera sessilis** Br., *H.F.B.I.*, iv, p. 731.
Syn.—Alternanthera triandra Lam.
Vernacular names.—Kanchri, Jaljamba.
Habitat.—A very common weed at Adigmet and other places. Flowers: August-January.

The following are commonly cultivated in gardens :—

228. **Telanthera ficoidea** Moq., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 499.
Syn.—Alternanthera amabilis of gardeners.
It makes an excellent edging for small beds.

229. **Gomphrena globosa** Linn., *Cooke. Fl. Bomb. Pres,* Vol. II, Pt. III, P. 499.
(The Globe Amaranth).
Vernacular name.—Jafri-gundi.

LXII. CHENOPODIACEÆ.

230. **Suæda maritima** Dumort., *H.F.B.I.*, v, p. 14.
Habitat.—Apparently a common weed in grassy places.

231. **Beta vulgaris** Linn., *H.F.B.I.*, v, p. 5.
(The Beet-root).
Vernacular names.—Chukhander (Hind.); *Palak* (Bomb.).
Uses.—It is much used in curries and salads.

LXIII. POLYGONACEÆ.

232. **Polygonum plebejum** Br., *H.F.B.I.*, v, 27.
Habitat.—A common herb, very variable.
Uses.—Medicinal.

233. **Antigonon leptopus** H. & Arn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 519.
Habitat—A native of South America, commonly cultivated.

LXIV. NEPENTHACEÆ.

234. **Nepenthes khasiana** Hook., *H.F.B.I.*, v, p. 70.
(The Pitcher-plant).
Habitat.—Khasia and Jyntea mountains. It is seldom cultivated. It is being grown in the Botanic Garden, Osmania University. But the climate does not seem to suit it, as it often puts on a sickly appearance.

LXV. ARISTOLOCHIACEÆ.

235. **Aristolochia indica** Linn., *H.F.B.I.*, v, p. 75.
Vernacular names.—Rudrajata, Ishvari (Sans.); *Isharmul* (Hind.); *Sapsund, Sampsum* (Bomb. and Mar.); *Perumarindu* (Tam.); *Ishvara-veru, govila* (Tel.).
Habitat.—Common in bushes.
Uses.—Root and leaves are medicinal.

236. **Aristolochia elegans** Masters, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 525.
Habitat.—A native of Brazil, commonly cultivated.

LXVI. LAURACEÆ.

237. **Cassytha filiformis** Linn., *H.F.B.I.*, v, p. 188.
Vernacular names.—Akas Valli (Sans.); *Amarbeli* (Hind.); *Akaswel, Amarvellu* (Mar).; *Cottan* (Tam.); *Paunch figa* (Tel.).
Habitat.—A common parasite on trees and shrubs. It is often mistaken for *Cuscuta*.
Uses.—Medicinal.

The following are cultivated :—

238. **Cinnamomum zeylanicum** Breyn., *H.F.B.I.*, v, p. 131.
(The Cinnamon of commerce).
Vernacular names.—Dalchini (Hind.); *Karruwa* (Tam.); *Sanalingul* (Tel.).
Uses.—The bark (*Dalchini*) is used to flavour curries and some sweets. Officinal.

239. **Cinnamomum camphora** F. Nees., *H.F.B.I.*, v, p. 134.
(The Camphor tree).
Vernacular name.—Kafoor-ka-jhar.
Uses.—Medicinal.

LXVII. EUPHORBIACEÆ.

240. **Euphorbia antiquorum** Linn., *H.F.B.I.*, v, p. 255.
Vernacular names.—Sihunda (Sans.); *Tindhara schund* (Hind.); *Naraseja* (Mar.); *Shadhurak-kalli, Tirikalli* (Tam.); *Bonta-chemudu* (Tel.).
Habitat.—Common in dry places.
Uses.—Medicinal.

241. **Euphorbia hypericifolia** Linn., *H.F.B.I.*, v, p. 249.
Vernacular names.—Hazardana (Pb.); *Nayeti Dudh mogra* (Bomb.); *Dhaktidudhi* (Mar.).
Habitat.—Wild.
Uses.—Medicinal.

242. **Euphorbia hirta** Linn., *H.F.B.I.*, v, p. 250.
Syn.—Euphorbia pilulifera Linn.
Vernacular names.—Dudhi (Hind.); *Nayeti* (Bomb.); *Dudhi* or *mothidudhi* (Mar.); *Amumpatchay-arissi* (Tam.); *Nanabala* (Tel.).
Habitat.—A very common weed.
Uses.—Medicinal.

243. **Euphorbia microphylla** Heyne., *H.F.B.I.*, v, p. 252.
Habitat.—Wild throughout.
Uses.—Medicinal.

244. **Euphorbia thymifolia** Burn., *H.F.B.I.*, v, p. 252.
Vernacular names.—Rakta vinda chada (Sans.); *Dudhi, Chotka dudhi* (Hind.); *Hazardana* (Pb.); *Chinamam* (Tam.); *Biduru nana biyyam* (Tel.); *Nayeti* (*Bomb.*); *Mathi-dudhi* (Mar.).
Habitat.—Also a common weed.
Uses.—Medicinal.

245. **Jatropha Curcas** Linn., *H.F.B.I.*, v, p. 383.
Vernacular names.—Nepalam (Tel); *Mogali-eranda* (Tel. and Bomb.).
Habitat.—Common near villages.
Uses.—Medicinal.

246. **Jatropha multifida** Linn., *H.F.B.I.*, v, p. 383.
Habitat.—A native of America. Cultivated.

247. **Jatropha podagrica** Hook., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 598.
Habitat—A native of Grenada. It has a curious gouty stem. Often cultivated.

248. **Cleistanthus collinus** Benth., *H.F.B.I.*, v, p. 274.
Vernacular names.—Korsi, kurchi-chettu (Tel.); *Woadugu mayam* (Tam.); *Garari* (Mar.).
Habitat.—Fruits were collected from the Mulug forest.
Uses.—Outer crust of capsule is said to be exceedingly poisonous. Medicinal.

249. **Phyllanthus reticulatus** Poir., *H.F.B.I.*, v, p. 288.
Vernacular names—Krishna-kamboji (Sans.); *Panjoli, Kala mahmooda* (Hind.); *Pavan, Datvan* (Bomb.); *Pillanji, Karappu-pillanji* (Tam.); *Purugudu, phulser* (Tel.).
Habitat.—Common in the vicinity of the city, and extremely common in Doulatabad and Khuldabad (Aurangabad District).
Uses.—The berries are edible. Leaves and bark are medicinal.

250. **Tragia involucrata** Linn., *H.F.B.I.*, v, p. 465.
Vernacular names.—Vrischi-kali (Sans.); *Barhanta* (Hind.); *Kan-churi* (Tam.); *Kauch kuri* (Bomb.); *China-dulagondi, druda-gunti* (Tel.); *Kauch-kuri* (local name, but the real Kauch-kuri is *Mucuna Pruriens* of the Leguminosae family).
Habitat.—A common twining herb in many hill-forests. The material was collected from a hillock near Kamareddy.
Uses.—Medicinal.

251. **Codiæum variegatum** Blume, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. IV, p. 626—the croton of gardens.

252. **Aleurites moluccana** Willd., *H.F.B.I.*, v, p. 384.
(The Belgaum Walnut).
Vernacular names—Akosta (Sans.); *Jangli-akhrot* (Hind.); *Girdagane hindi, Chahar maghze hindi* (Pers.); *Jangli akhrota Japhala, Akhod* (Mar.); *Nattu akrotu kottai* (Tam.).
Uses.—Medicinal.

LXVIII. URTICACEÆ.

253. **Ficus Tsiela** Roxb., *H.F.B.I.*, v, p. 515.
Habitat.—Common near villages in Aurangabad.

LXIX. CASUARINACEÆ.

254. **Casuarina equisetifolia** Forst, *H.F.B.I.*, v, p. 598.
Habitat.—Extensively planted, but not indigenous.

LXX. CERATOPHYLLACEÆ.

255. **Ceratophyllum demersum** Linn., *H.F.B.I.*, v, p. 639.
Habitat.—A very common water-plant.

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THE ORNITHOLOGICAL SURVEY OF JODHPUR STATE.

BY

HUGH WHISTLER.

In 1933 His Highness the Ruler of Jodhpur State suggested that our Society should make arrangements for an ornithological survey of Jodhpur State on the lines of the previous surveys undertaken by the Society and he further expressed his willingness to defray the cost of such a survey for a period of three months. Needless to say this handsome offer was gratefully accepted and the work in the field was put into the hands of Mr. V. S. La Personne, one of the Society's officers who had already taken part in the Eastern Ghats Survey.

It was not expected that any novelties would be discovered in Jodhpur State. This was quite unlikely in view of the arid and semi-desert character of the greater part of the State and its close correspondence with the neighbouring areas of Sindh, Rajputana and the Punjab, of which the birds were already very generally known. But it was felt that careful collecting over a period of three months could hardly fail to add something to our knowledge of an area of which so little was on record, even though it could only furnish a picture of part of the bird year.

Our previous knowledge of the birds of Jodhpur State is derived from three main sources. The first is the work of Mr. R. M. Adam who was resident at Sambhur for several years. About 1870-74 he was a correspondent of A. O. Hume's and made a large collection of birds which are now in the British Museum. The result of his observations was recorded in *Stray Feathers* as follows:—'Notes on the Birds of the Sambhur Lake and its vicinity', *Stray Feathers*, vol. i, pp. 361-404. 'Additional Note on the birds of the Sambhur Lake and its vicinity', *Stray Feathers*, ii, pp. 337-41 and pp. 465-6.

Sambhur Lake cuts across the north-east boundary of Jodhpur State and Adam treated of the area of the lake as a whole without considering political boundaries. As many of the birds mentioned are water birds and the area is not typical of Jodhpur State proper and as there is nothing to show in many cases which side of the boundary the birds came from this list has to be used with some discretion by the student of Jodhpur State.

The second authority for Jodhpur is Dr. King who collected at Mount Aboo and in Jodhpur for nearly two years. His birds are also in the British Museum. He unfortunately published no account of his observations but he supplied Hume with a manuscript list of species obtained in the plains of Jodhpur in spring, summer and autumn and that was largely drawn on by Hume in his notes to Captain Butler's paper, to be mentioned below (vide *S.F.*, iii, p. 440).

The third authority for the State is Allen Octavian Hume himself. He appears to have been in Jodhpur on more than one occasion but his only paper dealing with his own collecting in the area will be found in *Stray Feathers*, vol. vii, pp. 52-68, 'The Birds of a Drought'. This deals with a stay at Jodhpur city from 15 January to 15 February and with intensive collecting in an area of 8 to 10 miles round the city. Conditions were not however normal owing to the severe drought. He did however contribute a series of notes on the neighbouring areas, including Jodhpur, to an important paper by Captain E. A. Butler, 'Notes on the avifauna of Mount Aboo and Northern Gujerat' (*Stray Feathers*, iii, pp. 437-500 and iv, pp. 1-41). To this paper Hume also contributed one of his customary regional analyses which is of interest to the student of Jodhpur.

From these three sources I have abstracted as far as is practicable—for many of the references are in very general terms—the information which refers to Jodhpur State and adding it to the information which has been obtained by the present survey have thus prepared what can only be regarded as a very imperfect nominal list of the birds of Jodhpur State. My hope is that it may serve as a starting point for any fresh observer who may be stationed in Jodhpur and is able and willing to study the birds of the State in the way that they should be studied.

Mr. La Personne collected 361 birds during the survey. The following list shows the serial numbers of the specimens collected at each camp together with the period spent there.

Nos. 1-18; 8 Oct. 1933—9 Oct. 1933; Pali, Marwar District.

Nos. 19-140; 10 Oct. 1933—31 Oct. 1933; Hamavas Lake, Pali.

Nos. 141-211; 2 Nov. 1933—10 Nov. 1933; Jalor.

Nos. 212-238; 13 Nov. 1933—16 Nov. 1933; Bhinmal.

Nos. 239-300; 21 Nov. 1933—2 Dec. 1933; Sunda Hill, Jaswantpura District.

Nos. 301-316; 2 Dec. 1933—5 Dec. 1933; Jawar, Jaswantpura District.

Nos. 317-330; 6 Dec. 1933—21 Dec. 1933; Tilwara.

Nos. 331-351; 1 January 1934—5 January 1934; Phalodi.

Nos. 354-361; 8 January 1934—14 January 1934; Pichiak Lake, Bilara District.

It will be realised, therefore that Mr. La Personne must have worked very hard in collecting and skinning. He did not however furnish any field notes of importance on the collection or any notes on the collecting areas so I fear that my report can be little but a nominal list of the specimens collected, supplemented by such notes as I have procured from the three main sources outlined above. Critical discussions of races have not been called for as whatever might have been said on these particular species has already been said by Dr. Ticehurst in his Sind papers or by myself in connection with the Punjab or in the various survey papers.

Any Gazetteer may be consulted for a general description of Jodhpur State. With these few preliminary remarks I now proceed to enumerate the species and subspecies either procured by the survey or otherwise recorded as occurring in Jodhpur State.

Corvus corax laurencei Hume.

Specimen collected :—338 ♀ 2-1-34 Phalodi ; 358 ♀ 12-1-34 Pichiak Lake, Bilara.

Found throughout the whole State in the winter months. Hume remarks on the boldness of this Raven. 'Our camp, he says, was a large one perhaps containing a thousand souls and in amongst the tents from dawn till dark, familiar and fearless as sparrows, were at all times from 50 to 100 of these Ravens, stalking about singly and croaking vigorously to each other'. La Personne also remarks on the tameness of the bird in the desert towns. In Phalodi they actually entered the bungalow verandas and no. 338 was caught with a basket and string trap. A nest with 2 fresh eggs was seen on 19 December on a signal platform of the railway at Tilwara, the birds being but little disturbed by passing trains. Many old nests were seen in the desert outside Chanod, mostly placed on acacia trees barely 6 foot high.

Corvus macrorhynchos Wagler.

La Personne reports that a single Jungle-Crow was seen in His Highness' garden at Jaswantpura, no doubt as a straggler from the Aravallis. Hume and Adam failed to meet it either at Jodhpur or Sambhur.

Corvus splendens splendens Vieillot.

Specimens collected :—187 ♂ ad. 6-11-33, ♀ad. 10-11-33 Jalor 500 ft.

Hume found the House-Crow rare at Jodhpur under drought conditions, but La Personne says it occurs throughout the greater part of the State except in the more arid regions. It was common at Barmer in December. In some localities, such as Puchbunddra, according to Hume the House-Crow is only a rains visitor (*S.F.*, iii, 493).

La Personne furnishes an interesting note on the roosting flight of this species in Jaswantpura district. The evening flight passed over his camp at 3,400 ft. on Sunda Hill and from that elevation he could see the birds leaving the plains in huge flocks and crossing the hill at one particular dip in the ridge, making for the Abu range. The first flock would cross (at the end of November and beginning of December) about 5.30 p.m. and then with intervals of a minute or two between each flock the flight would continue until about 6-45 to 7 p.m. The morning flight was over before sunrise. Some of these birds doubtless came from great distances, as when the survey was at Jalor and Tilwara the start of the evening flights was noticed.

Both specimens collected belong to the typical form and La Personne particularly remarks that throughout the survey he noticed that all House-Crows were typical in colour and not of the paler *zugmayeri* form.

Dendrocitta vagabunda pallida Blyth.

Specimens collected :—♀ imm. 10-10-33 Hamavas Lake ; 306 ♀ ad. 4-12-33, 313 ♂ ad. 5-12-33 Jawar, Jaswantpura District.

The Indian Tree Pie was common in and around Jodhpur town but the specimen collected at Hamavas Lake appeared to be the only individual in the strip of Babul jungle growing along the dam. A pair visited the camp on Sunda Hill, 3,400 ft.

Specimens collected will pass in colour as *pallida* though their measurements (♂♀ ad. wing 161, 150 tail 259, 235 mm.) are a little on the small side. Lal Personne remarks, however, that the pair on Sunda Hill appeared to be larger with longer tails.

Parus major mahrattarum Hartert.

Specimens collected :—244 ♀ 245 ♂ 21-11-33, 248 sex ? 22-11-33, 262 ♂ 23-11-33, 271 ♀ 25-11-33, 286 ♂ 28-11-33, 294 ♀, 295 ♂ 29-11-33,- Sunda Hills, 3,400 ft., Jaswantpura.

The Indian Grey Tit was plentiful on Sunda Hill frequenting the ravines and old watercourses and being found in the hunting parties with White-eyes and Willow-wrens. There is a specimen in the Hume collection obtained on the Desuri Road from Jodhpur on 10 February 1878 and it is also found in the Marot and Koochamun jungles to the north of the Sambhur Lake.

Parus nuchalis Jerdon.

The survey unfortunately failed to meet with the White-winged Black Tit but it occurs along the eastern borders of the Jodhpur State as Adam found it quite common towards Marot and Mokrana, and Hume (*S.F.*, iii, 492) obtained it from the neighbourhood of Pali.

Turdoides somervillei sindianus (Ticehurst).

Specimens collected :—279 ♀ 27-11-33, Sunda Hill, 3,400 ft.

This specimen of the Jungle Babbler was secured from a family party on Sunda Hill. The species was not otherwise observed though Hume included the bird in his Jodhpur list.

Argya caudata caudata (Dumont).

Specimens collected :—4 sex ? juv., 9 ♀ ad. 10 ♂ juv., 8-10-33 Pali; 118 ♂, 119 ♂, 120 ♀ 21-10-33 Hamavas Lake, Pali district; 323 ♂ 19-12-33 Tilwara, 348 ♀ ad., 349 ♀ imm. 5-1-34 Phalodi.

The Common Babbler is one of the most common and generally distributed birds in the State though it was not found in the hill area of Jaswantpura district. Young and eggs were noted in October.

Argya malcolmi (Sykes).

Specimens collected :—142 ♂ 31-10-33, 164 ♀ 3-11-33, 170 ♀ 4-11-33 Jalor.

The Large Grey Babbler is very common at Jodhpur and extends to Balotra, Siwaria and Jalor, though it is absent according to La Personne from the desert region further west and from the hills of Jaswantpura.

Chrysomma sinensis hypoleucos (Franklin).

Specimens collected :—19 ♂ 10-10-33, 34 ♂ 11-10-33, 49 ♂ 13-10-33, 138 ♀ 25-10-33 Hamavas Lake; 259 ♂, 260 ♂, 261♂ juv., 23-11-33, 267 ♀ 25-11-33, Sunda Hill, 3,400 ft.; 301 ♂, 302 ♀ 2-12-33, Jawar, Jaswantpura district; 354 ♂ 355 ♀ 8-1-34, Pichiak Lake.

The Yellow-eyed Babbler is common on Sunda Hill in the bamboo-jungle and was also found on the plains in Tamarisk and Babool forests and in the reed beds and grass lands round the larger lakes, but was met by the Survey nowhere west of a line roughly through Jodhpur, Jalor, Bhinmal and Jaswantpura. Adam obtained it from the hills near Koochamun. The young male no. 261 was probably not more than a month old and was secured from family party.

Aegithina nigrolutea (Marshall).

Aegithina tiphia (L.).

Specimens collected :—268 ♂ imm. 25-11-33, Sunda Hill, 3,000 ft.

La Personne says that an Iora was not uncommon on Sunda Hill. When Hume wrote in 1875, before the two species of Iora had been differentiated, he said that the Iora was common in the eastern portions of Jodhpur but occurred for the most part only in the rains in western Jodhpur. The solitary specimen obtained by the Survey—which was in company with a party of White-eyes in a large Banyan tree—is immature and therefore cannot be identified subspecifically but it appears to me to be of the species ***tiphia***. A specimen in the Hume collection from the hills near Koochamun is, however, *nigrolutea* to which species also belong the Ioras collected by Adam at Sambhur and a specimen from Anadra (just over the Jodhpur border near Mount Aboo) in the Hume collection. It is evident, therefore, that both forms of Iora occur in Jodhpur State but their status and distribution and the exact relationship between them remain to be worked out.

Molpastes haemorrhous pallidus Stuart Baker.

Specimens collected :—108 ♀, 109 ♂ 20-10-33, 116 ♀ 21-10-33, Hamavas Lake, Pali.

The Red-vented Bulbul is common on the hills of the Jaswantpura district and extends into the plains, as at Jodhpur, Barmer and Phalodi where conditions are suitable. In western Jodhpur, according to Hume it occurs for the most part only in the rains. Fledged young were seen being fed by their parents on 18 October.

Molpastes leucogenys leucotis (Gould).

Specimens collected :—26 ♂ 11-10-33, 64 ♀ 15-10-33, 105 ♂ 20-10-33, 117 ♀ 21-10-33, 126 ♂ 22-10-33, 130 ♀ 132 sex ? 23-10-33 ; Hamavas Lake, Pali ; 163 ♂ 3-11-33, Jalor.

The White-eared Bulbul is one of the most familiar and widely spread birds in the State, inhabiting light babul forest, cactus-covered land and the semi-desert country round villages. It is plentiful at Barmer and Phalodi and about Nawa and Mata Pahar on the Sambhur Lake. La Personne remarks that both species of Bulbul were common on the hillside at Hamavas which was thickly covered with cactus, and on more than one occasion individuals of the two species were observed in company, though no hybrids were observed.

Salpornis spilonota rajputanae Meinertzhagen.

There are a pair of specimens of the Spotted Grey Creeper in the British Museum collected by Adam on the 6th and 25th of June 1873 and labelled Sambhur. These are presumably the two specimens which Adam says he obtained in the jungle near Koochamun.

Saxicola caprata bicolor Sykes.

Sepcimens collected :—38 ♀ 12-10-33, 72 ♂ 16-10-33, 79 ♂ 17-10-33, 88 ♂ 18-10-33 ; Hamavas Lake ; 161 ♂ 3-11-33, 165 ♂ 4-11-33, 173 ♂, 174 ♂, 175 ♀ 5-11-33, 184 ♂ 6-11-33 ; Jalor ; 232 ♀ 16-11-33, Bhinmal.

The Pied Bush-chat is very common and generally distributed in Jodhpur, occurring both in the desert country and on the hill top at Sunda.

Saxicola torquata indica (Blyth).

Specimens collected :—87 ♂ 18-10-33 Hamavas Lake ; 178 ♂ 5-11-33 Jalor ; 212 ♂ 13-11-33, 244 ♂ 15-11-33 Bhinmal.

The Stone-chat is a common winter visitor.

Saxicola macrorhyncha (Stoliczka).

Stoliczka's Whin-chat was not procured by the Survey but Hume found it 'extremely common in the thin, stunted scrub jungle that here and there studs the sandy, semi-desert, waterless tracts that occur all round Jodhpur'. He procured a large series of over 30 specimens (now in the British Museum) at the end of January and during the first week in February and wrote an interesting note on them (*S.F.*, vii, 55). It is no doubt resident.

Oenanthe picata (Blyth).

Specimens collected :—2 ♂ 8-10-33 Pali ; 150 ♂ 2-11-33 Jalor.

Although scarce at the beginning of October the Pied Wheatear, says La Personne, increased in numbers with the colder weather and was very generally distributed except in the forested areas. At Jalor and other rest-houses they often rested on the doors and windows during the heat of the day and at Jalor a fine male roosted regularly on the 'kass-kass' door.

Oenanthe opistholeuca (Strickland).

Strickland's Wheatear was not procured by the Survey but Hume says it occurs here and there throughout Jodhpur, of course as a winter visitor only.

Oenanthe isabellina (Temm.).

Specimens collected :—1 ♂ 3-10-33, 7 ♂ 8-10-33 Pali.

The Isabelline Wheatear is said by La Personne to be very generally distributed except in the hill tracts of Jaswantpura.

Oenanthe deserti atrogularis (Blyth).

Specimens collected :—146 ♀ 1-11-33, 183 ♂ 6-11-33 Jalor ; 337 ♀ 2-1-34 Phalodi.

The Desert-Wheatear was found to be very common at Barmer and Phalodi.

Oenanthe xanthoprymna chrysopygia (De Filippi).

The Red-tailed Wheatear was not procured by the Survey but Hume obtained it in the neighbourhood of Jodhpur and wrote a long note on its correct name (p. 57).

Cercomela fusca (Blyth).

Specimens collected :—162 ♂ 3-11-33, 188-9 ♂♂ 6-11-33, 191 ♂ 194-5 ♀♀ 7-11-33 Jalor; 240 ♀, 243 ♂ 21-11-33, 275 ♂ 26-11-33 Sunda Hill, 3,400 ft.

La Personne says that the Brown Rock-chat is very irregularly distributed in Jodhpur State. He found it common at Phalodi, at Jalor and on the Sunda Hill whereas it was not observed at Marwar Pali or at Barmer and further west of the latter place.

Phoenicurus ochrurus phoenicuroides (Horsfield and Moore).

Specimens collected :—45 ♀ 12-10-33 Hamavas Lake; 167 ♂ 4-11-33, 182 ♀ 6-11-33, 208 ♂ 10-11-33 Jalor.

The Black Redstart was found to be very generally distributed.

Cyanosylvia suecica pallidogularis (Sarudny).

Specimens collected: 46 ♂ 12-10-33, 61 ♀ 14-10-33, 62 ♀ 15-10-33, 112 ♂ 21-10-33, 127 ♂ 22-10-33 Hamavas Lake.

La Personne says that a large influx of Bluethroats was observed on the 21 October at Hamavas where there is most suitable ground for them covered with reeds and tamarisk beyond the lake-dam. Many were flushed from chilli crops at Jalor and a single bird was seen in a patch of pulse in the Rest-house garden at Barmer. Hume remarked long ago that in the more desert portions of Jodhpur the Bluethroat seems to be chiefly found towards the close of the rains, that is on the autumn passage.

The identification of Bluethroats in winter plumage in India is largely a matter of guess work but these specimens apparently belong to the race *pallidogularis*.

Saxicoloides fulicata cambaiensis (Latham).

Specimens collected :—83-84 ♀♂ 17-10-33, 107 ♂ 20-10-33 Hamavas Lake; 151 ♂ 2-11-30 Jalor.

The Brown-backed Indian Robin is absent from the desert areas, such as Barmer and Phalodi, but seems to be generally distributed and common on the eastern side of the State. Hume was of opinion that specimens from western Jodhpur (*S.F.*, iii, 474) were of the type which I have since named *intermedia* but the Survey specimens are clearly *cambaiensis*.

Copsychus saularis saularis (Linnaeus).

Specimen collected :—310 ♂ 4-12-33 Jawar, Jaswantpura District.

Local and apparently absent from the desert tracts, the Magpie Robin is said by La Personne to occur at Chanod, along the Jawai River and at Jodhpur, Balotra and Pali.

Monticola cyanus pandoo (Sykes).

Specimens collected :—133 ♂ 23-10-33 Hamavas Lake; 186 ♂ 6-11-33 Jalor.

The Blue Rock Thrush was first seen on 20 October at Hamavas. It was noted on Sunda Hill. Hume includes it in his list from the neighbourhood of Jodhpur.

Muscicapa striata neumanni Poche.

The autumn passage route of the Spotted Flycatcher includes Jodhpur as Hume received specimens collected in the State on September 8th and 16th. The Survey was too late to meet with it.

Siphia parva parva (Bechstein).

Specimens collected :— 55 sex ? 14-10-33, 58 ♂ 12-10-33 Hamavas Lake.

The Red-breasted Flycatcher is also included in Hume's Jodhpur list.

Leucocirca aureola aureola (Lesson).

Specimens collected :—53 ♂ 14-10-33 Hamavas Lake ; 314 ♀ 5-12-33 Jawar, Jaswantpura district.

The White-browed Fantail-Flycatcher is a common bird in the gardens of Jodhpur town and in the Babul groves of the eastern side of the State. Adam met a few pairs about Nawa and Marot. According to La Personne it does not occur west of Balotra.

Lanius excubitora lahtora (Sykes).

Specimens collected :—3 ♂, 8 sex ?, 15 ♂ 8-10-33 Pali ; 144 ♂ 1-11-33 Jalor.

The Indian Grey Shrike is extremely common throughout the State except in the forests of Jaswantpura and the wetter areas round the lakes. Occurs on Sunda Hill.

Lanius vittatus Valenciennes.

Specimens collected :—70 ♂ juv. 16-10-33 Hamavas Lake ; 305 ♂ 4-12-33 Jawar, Jaswantpura district.

According to La Personne the Bay-backed Shrike is found all along the eastern side of the State, and also wherever suitable conditions occur on the western side though it avoids the desert country. Noted at Barmer and Phalodi and in most Rest-house gardens. Adam found it breeding commonly in the Marot jungles on 1 August 1872.

Lanius schach erythronotus (Vigors).

Specimens collected :—80-81 ♀ ♂ 17-10-33 Hamavas Lake.

The Rufous-backed Shrike was fairly generally distributed, being also noted by the Survey at Phalodi, Godra Road and Barmer and in the Jaswantpura district.

Lanius isabellinus Hempich Ehrenberg.

Specimens collected :—25 ♀ 11-10-33, 111 ♂ 20-10-33 Hamavas Lake ; 160 ♂ 3-11-33 Jalor ; 216 ♂ 14-11-33 Bhinmal ; 328 ♀ 21-12-33 Tilwara.

The Isabelline Shrike is common throughout the whole State, according to La Personne, in all the drier and semi-desert areas.

Tephrodornis pondicerianus pallidus Ticehurst.

Specimens collected :— 168 sex ? 4-11-33, 176 ♀ 5-22-33 Jalor ; 281 ♂ 27-11-33 Sunda Hill 3,400 ft. ; 308-309 ♂ ♂ 4-12-33 Jawar, Jaswantpura district.

The Common Woodshrike occurs wherever there is suitable Babul forest or bush-covered country and it was noted in the tamarisk forest at Tilwara. The specimens collected are intermediate between the typical race and *T. p. pallidus* but on the whole are closer to the latter.

Pericrocotus brevirostris (Vigors).

Hume states that the Short-billed minivet appears in winter in the southern portions of Jodhpur but it was not procured by the Survey.

Pericrocotus erythropygius (Jerdon).

No minivets were collected by the Survey but Hume procured the White-bellied Minivet in the neighbourhood of Jodhpur town and Adam collected specimens in the jungles near Marot and Koochamun.

Dicrurus macrocercus albirictus (Hodgson).

Specimens collected :—56-7 ♂ ♀ 14-10-33 Hamavas Lake, Pali ; 153-4 ♂ ♂ 2-11-33 Jalor, 500 ft. ; 235 ♀ 16-11-33 Bhinmal.

The King Crow is very generally distributed throughout the State in suitable country.

Dicrurus longicaudatus Jerdon.

Specimen collected :—297 ♂ 29-11-33 Sunda Hill, 3,400 ft.

This specimen appears to provide the only record of the Grey Drongo for Jodhpur State. It is doubtless a winter visitor only.

Agrobates galactotes familiaris (Ménétries).

As in the case of certain other species which take the Arabian route to their winter quarters in Africa, the Rufous Warbler appears in Jodhpur on passage in September in which month in 1868 Dr. King obtained two specimens now in the British Museum (vide *S.F.*, iii, 476 and *Ibis*, 1869, 355).

Acrocephalus stentoreus brunnescens (Jerdon).

Specimens collected :—45-48 ♂♂,♀♂ 13-10-33, 63 ♂ 15-10-33, 69 ♂ 16-10-33, 75 ♀, 77 ♂ 16-10-33, 113 ♂ 20-10-33, 115 ♂ 21-10-33 Hamavas Lake, Pali.

The Great Reed Warbler was abundant in the extensive reed beds that were examined by Hamavas Lake and they were found to visit the neighbouring tamarisk forest. All the specimens are undergoing a complete moult and it seems extremely probable that the birds breed where they were found, though no old nests were remarked by the Survey, and there are no juveniles amongst the specimens collected.

Acrocephalus dumetorum Blyth.

Specimens collected :—30, 32 sex ? 11-10-33 Hamavas Lake.

Mr. La Personne is of opinion that Blyth's Reed Warbler was very generally distributed in gardens and other suitable places. It was probably on passage.

Orthotomus sutorius guzerata (Latham).

Specimens collected :—123-124 ♂♀ 22-10-33, 134 ♂ 23-10-33 Hamavas Lake; 155 ♂ 2-11-33, 192 ♂ 7-11-33, 197-198 ♂♂ 8-11-33 Jalor; 250-251 ♂♀ 22-11-33 Sunda Hill, 3,400 ft.

The Tailor-bird was not observed westwards of Tilwara and it does not occur in the desert areas.

Cisticola juncidis cursitans (Franklin).

Specimens collected :—104 juv. 20-10-33 Hamavas Lake; 220-222 ♀♂ sex ? 14-11-33, 229 ♀ 15-11-33, 231 ♂ 16-11-33 Bhinmal.

In addition to the above localities the Fantail Warbler was noted, a single specimen only, at Tilwara. It is of course absent from the desert tracts.

Franklinia gracilis (Franklin).

Specimens collected :—246-7 ♀♂ 21-11-33, 249 ♀ 22-11-33, 256-7 juvs. 23-11-33 Sunda Hill, 3,400 ft.; 316 ♂ 5-12-33 Jawar, Jaswantpura.

Franklin's Wren-Warbler was found in the grasslands which grow to a height of over 4 feet in places, on the Sunda Hill. Adam's collector found it fairly common in the hills near Koochamun.

Franklinia buchanani (Blyth).

Specimens collected :—6 ♂ juv. 8-10-33 Pali; 27 ♂ 11-10-33, 99 sex ? 102 juv. 19-10-33, 106 ♀, 110 ♀ juv. 20-10-33, 122 juv. 22-10-33, 131 ♂ 23-10-33, 137 ♀ 24-10-33 Hamavas Lake; 141 ♂ 31-10-33, 152 ♀, 156 ♂ 2-11-33, 199 ♂ 8-11-33 Jalor; 329 ♂ 21-12-33 Tilwara; 343 ♂ 3-1-34 Phalodi.

Hume stated that the Rufous-fronted Wren-Warbler was very common about Jodhpur and La Personne adds that it is very widely distributed in the State, being there as elsewhere more particularly addicted to the semi-desert tracts thickly studded with the *Zyziphus* bush.

Hippolais rama rama (Sykes).

Specimen collected :—29 ♀ 11-10-33 Hamavas Lake.

Syke's Tree Warbler is probably a passage migrant.

Sylvia communis rubecula Stresemann.

According to Hume (*S.F.*, iii, 488) Dr. King collected specimens of the Common White-throat at Jodhpur itself and near Pali in September. The specimens are not in the British Museum but they doubtless belong to this race. This is another of the species that pass through north-west India on the autumn passage to take the Arabian route to Africa and their winter quarters.

Sylvia crassirostis jerdoni (Blyth).

Specimens collected :—136 ♀ 24-10-33 Hamavas Lake, Pali. Hume procured the Orphean Warbler at Jodhpur but considered it rare.

Sylvia nana nana (Hemprich & Ehrenberg).

Specimens collected :—331-333 ♂ ♀ ♀ 1-1-34 Phalodi.

The desert areas of Jodhpur State are particularly suited to the requirements of the Desert Warbler and Hume found it extremely abundant in the low scrub round Jodhpur.

Sylvia curruca blythi Ticehurst & Whistler [*Sylvia affinis* auct.].

Specimens collected :—14 ♂ 8-10-33 Pali; 21 ♂ 10-10-33, 35 ♂ 11-10-33, 121 ♂ 22-10-33 Hamavas Lake, Pali; 159 ♂ 3-11-33 Jalor; 241 ♀ 21-11-33 Sunda Hill, 3,400 ft.

Sylvia curruca minuta Hume.

Specimen collected :—219 ♀ 14-11-33 Bhinmal.

These two subspecies of the Lesser White-throat were 'excessively common' when Hume was collecting at Jodhpur in January and February. His paper contains very important notes on the discrimination and distribution of these two subspecies and of the allied *Sylvia althaea.*

Phylloscopus collybita tristis Blyth.

Specimens collected :—33 ♂ 11-10-33, 39 ♀ 12-10-33, 140 sex ? 25-10-33 Hamavas Lake, Pali; 330 ♀ 21-12-33 Tilwara.

Phylloscopus griseolus Blyth.

Specimens collected :—252 ♂ 22-11-33, 263 ♀ 24-11-33 Sunda Hill, 3,400 ft.

Prinia gracilis lepida Blyth.

Hume says that the Streaked Wren Warbler was very common about Jodhpur but it was not procured by the Survey.

Prinia socialis stewarti Blyth.

This race of the Ashy Wren Warbler is said by Hume to occur in Jodhpur though he adds that it is nowhere common. It was not procured by the Survey.

Prinia sylvatica gangetica (Blyth).

Specimens collected :—239 ♂ juv. 21-11-33, 253-4 ♀ ♂ juv. 22-11-33; 258 ♂ 23-11-33, 265 ♂ juv. 24-11-33, 270 juv. 25-11-33, 272 ♀ 26-11-33, 278 ♀ juv. 27-11-33, 285 ♂ juv., 287 ♀ ad. 288 juv. 28-11-33 Sunda Hill, 3,400 ft.

These specimens of the Jungle Wren-Warbler are of particular interest in that they confirm my opinion, given in full in *Jour. Bom. Nat. Hist. Soc.*, xxxvi, 575, that birds from Mount Aboo could not be separated from those of the rest of northern India. Specimens were procured by Adam in the Koochamun jungles and by Dr. King at Jodhpur.

Prinia inornata terricolor (Hume).

Specimens collected :—28 ♂ 11-10-33, 47 ♀ juv. 12-10-33, 82 ♀ juv. 17-10-33, 86 juv. 18-10-33, 128 ♂ juv. 22-10-33 Hamavas Lake, Pali.

The specimens of the Indian Wren-Warbler are all either juveniles or adults in heavy moult and therefore cannot be identified racially with complete certainty. They presumably belong to the northern race.

Oriolus oriolus kundoo Sykes.

The Golden Oriole was not procured by the Survey. Hume however states that it is 'common in the eastern, rare in the western portions of Jodhpur'.

Pastor roseus (Linnaeus).

The Rosy Pastor is said by Hume to be common in Jodhpur in the cold weather. It was not procured by the Survey.

Sturnus vulgaris Linnaeus.

Hume says that the Starling is a very common visitor to Jodhpur but I have seen no specimens from the area and cannot say what race or races occur.

Temenuchus pagodarum (Gmelin).

Specimens collected :—11 ♀ 8-10-33 Pali ; 139 ♀ 25-10-33 Hamavas Lake ; 185 ♀ 6-11-33 Jalor.

Hume considered the Brahminy Mynah to be fairly common in Jodhpur.

Acridotheres tristis tristis Linnaeus.

The Common Mynah is not represented among the specimens collected by the Survey but Hume says it is common in the State.

Acridotheres ginginianus (Latham).

Hume says that the Bank Mynah is common in the State.

Ploceus philippinus philippinus (Linnaeus).

Specimens collected :— 13 ♀ 8-10-33 Pali, 22 ♀ 10-10-33, 40, 43, 44 juvs. 12-10-33 Hamavas Lake, Pali.

According to Hume the Baya is common during the rains but less plentiful and more local during the rest of the year.

Uroloncha malabarica (Linn.).

Specimens collected.—37 ♂ 11-10-33, 65 ♂ 66 ♂ 68 ♂ 15-10-33 Hamavas Lake ; 223 ♀ 14-11-33 Bhinmal.

Judging by the organs of the specimens collected the White-throated Munia was about to breed at Hamavas Lake.

Amandava amandava amandava (Linnaeus).

Specimens collected :—51-52 ♂♀ 13-10-33, 78 ♀ 16-10-33, 90-92 ♂♂♂ 18-10-33, 100-101 ♂♀ 19-10-33 Hamavas Lake, Pali.

The Red Avadavat was evidently breeding at Hamavas Lake as the males had the organs enlarged and the females were laying eggs.

Carpodacus erythrinus (Pallas).

Recorded by Hume for Jodhpur State.

Bucanetes githaginea crassirostris (Blyth).

Hume saw and obtained a single male of the Trumpeter Bullfinch near Jodhpur and it also occurs in Jaisalmer but the Survey failed to meet with it.

Gymnorhis xanthocollis transfuga Hartert.

Specimens collected :—71 ♂, 76 ♀ 16-10-33, 129 ♂ 22-10-33 Hamavas Lake, Pali ; 172 ♂ 4-11-33 Jalor.

These specimens of the Yellow-throated Sparrow are somewhat intermediate in colour between the typical race and *G. x. transfuga*, but they are on the whole closer to the latter.

Passer domesticus parkini Whistler.

Specimens collected :—217 ♀, 218 ♂ 14-11-33, 225 ♂ 15-11-33 Bhinmal.

No. 218 with a wing measurement of 81 mm. clearly belongs to the large race of the House-Sparrow. So the probability is that the other two birds, which are on the larger side of the overlap of measurements common to both *parkini* and *indicus*, belong also to *parkini*. No doubt it is a winter visitor here as I found a marked passage through Jhang in September (*Ibis*, 1922, 272).

Passer hispaneolensis (Temminck).

Adam informs us that he found the Spanish Sparrow very plentiful in the "Keggara" jungles near to the town of Koochamun during the cold season.

Emberiza stewarti Blyth.

Specimens collected :—264 ♀ 24-11-33, 280 ♂ 27-11-33, 283 ♀ 28-11-33, 291-2 ♂ ♀ 29-11-33 Sunda Hill, 3,400 ft.

The White-headed Bunting is of course only a winter visitor to Jodhpur.

Emberiza buchanani Blyth.

Specimens collected :—18 ♂ 8-10-33 Pali; 346 ♂ 5-1-34 Phalodi.

The Grey-necked Bunting was found 'in huge flocks' at Pali according to the label of the specimen. Adams procured specimens in the low range of hills close to Nawa and about Koochamun.

Emberiza melanocephala Scopoli.

Specimen collected :—143 ♂ 1-11-33 Jalor.

The survey specimen is completing an entire moult. Hume says that at Soojut (north-east of Pali) he found the Black-headed Bunting in 'simply millions' at the time of the spring harvest.

Emberiza icterica Eversmann.

Specimen collected :—179 ♂ 5-11-33 Jalor, 500 ft.

This bird is also completing an entire moult. Hume says that he procured the Red-headed Bunting at Soojut and Pali where it was closely associated with the Black-headed Buntings. Both species occurred in joint flocks.

Emberiza striolata striolata Lichtenstein.

Specimen collected :—196 ♂ 7-11-33 Jalor, 1,000 ft.

Hume met with the Striolated Bunting near Jodhpur but says that it was only found on the flanks of the rocky hills. Adams found it in the scrub jungles about the hills near to Nawa and Marot.

Melophus lathami subcristata Sykes.

Specimens collected :—268 ♂ 25-11-33, 276 ♂ 26-11-33, 293 ♀ 29-11-33 Sunda Hill, 3,400 ft.

Adam's collector found the Crested Bunting common in the Koochamun hills.

Riparia paludicola brevicaudata Horsfield.

According to Hume the Indian Sand Martin is found in Jodhpur but is comparatively rare.

Riparia concolor (Sykes).

Specimens collected :—190 ♀, 193 ♂ 7-11-33 Jalor, 1,000 ft.

Hume met with the Dusky Crag Martin near Jodhpur but says that it was rare. Adam obtained it near Mata Pahar and the western end of the Sambhur Lake, and at Mata Pahar it was found by Hume to be breeding.

Hirundo rustica rustica Linnaeus.

Specimen collected :—95 ♀ 19-10-33 Hamavas Lake.

Hume obtained the Common Swallow at Jodhpur in the winter. From his remarks (*S.F.*, iii, 451) it seems that the Eastern race *H. r. gutturalis* may also occur in Jodhpur.

Hirundo daurica erythropygia Sykes.

Specimens collected :—200-202 ♂ ♂ ♀ 8-11-33 Jalor.

All three specimens are completing an entire moult. Hume remarks that this Red-rumped Swallow is common during the rains in Jodhpur but rare in the hot season.

Hirundo daurica nepalensis Hodgson. [?].

Specimen collected :—93 ♀ 19-10-33 Hamavas Lake.

This is a poor specimen, probably immature, very worn and with the wings commencing to moult but it seems to me to belong to the Himalayan race of Red-rumped Swallow.

Motacilla alba dukhunensis Sykes.

The White Wagtail was procured by Hume at Jodhpur in the winter but the Survey did not obtain it.

Motacilla maderaspatensis Gmelin.

The Large Indian Wagtail is said by Hume to occur about Jodhpur town but only sparingly.

Motacilla cinerea caspica (S. G. Gmelin).

The Grey Wagtail is said by Hume to occur in Jodhpur.

Motacilla feldegg melanogriseus (Homeyer).

The Black-headed Wagtail is said by Hume to occur in Jodhpur.

Motacilla flava subsp ?

Specimens collected :—67 ♀ 15-10-33, 103 ♀ 19-10-33 Hamavas Lake.

It is not possible to identify these female wagtails subspecifically.

Motacilla citreola calcarata Hodgson.

Hume received the Yellow-headed Wagtail from Jodhpur.

Anthus trivialis Linnaeus.

Recorded by Hume from Jodhpur.

Anthus rufulus waitei Whistler.

Specimen collected :—230 ♂ 16-11-33 Bhinmal.

Hume remarks that he had received no specimen of the Common Indian Pipit from Jodhpur.

Anthus spinoletta blakestoni Swinhoe.

There are no Jodhpur examples in the British Museum but Hume recorded this species and the race may be inferred.

Anthus campestris (Linnaeus).

The Survey curiously enough did not procure the Tawny Pipit but Hume includes it in his Jodhpur list.

Melanocorypha bimaculata (Ménétries).

Specimens collected :—344-345 ♂♂ 4-1-34, 350-353 ♂♂♂♂ 5-1-34 Phalodi.

Calandrella brachydactyla longipennis (Eversmann).

Specimens collected :—145 ♂, 147-8 ♂♂ 1-11-33, 204-206 ♂♂♂ 10-11-33 Jalor; 226-7 ♂♀ 15-11-33 Bhinmal; 318 ♂ 19-12-33 Tilwara; 341-2 ♂♀ 2-1-34, 347 ♂ 5-1-34 Phalodi.

Hume found the Short-toed Lark very common at Jodhpur, and it is no doubt general and common as a winter visitor as King procured it at Pali on 16 September 1868 and Blanford got it east of Bahmir-Malani on 10 February 1876.

Alauda gulgula (Franklin).

Said by Hume to occur in Jodhpur.

Mirafra cantillans (Blyth).

According to Hume the Singing Bush-Lark occurs sparingly in the western parts of Jodhpur.

Mirafra erythroptera sindiana Ticehurst.

Specimen collected :—94 ♂ 19-10-33 Hamavas Lake.

Hume considered the Red-winged Bush-Lark common in Jodhpur.

Galerida cristata chendoola (Franklin).

Specimens collected :—319-321 ♀ ♀ ♂ Tilwara, R. Luni.

The Crested Lark was very common at Jodhpur according to Hume.

Ammomanes phoenicura (Franklin).

The Rufous-tailed Finch-Lark is said by Hume to be common in Jodhpur.

Eremopteryx grisea grisea (Scopoli).

Specimens collected :—17 ♀ 8-10-33 Pali; 157-158 ♂ ♀ 3-11-33, 166 ♀ juv. 4-11-33, 177 ♀ 5-11-33, 207 ♀ 10-11-33, 209 ♂ imm., 210 ♀ juv. 10-11-33 Jalor; 214 ♂ 13-11-33, 215 juv. 14-11-33 Bhinmal.

The above specimens of the Ashy-crowned Finch-Lark are intermediate in colour between the typical race and *E. g. siccata* but they are if anything closer to the typical race. Hume got no specimens of this Lark at Jodhpur but it was collected there by Dr. King and is said to be common.

Eremopteryx albicollis affinis (Blyth).

Specimens collected :—334-336 ♀ ♂ ♂ 1-1-34, 339-340 ♂ ♀ 2-1-34 Phalodi.

Hume found the Black-crowned Finch-Lark extremely common in the sandy wastes about Jodhpur and he says that it extends into Jaisalmer. He collected a good series and gives a detailed note on the various plumages.

Zosterops palpebrosa occidentis Ticehurst.

Specimens collected :—242 ♂ 21-11-33, 273 ♂ 25-11-33 Sunda hill, 3,400 ft.; 303-4 ♂ ♀ 2-12-33 Jawar, Jaswantpura.

Cinnyris asiatica asiatica (Latham).

Specimens collected :—16 ♂ 8-10-33 Pali; 114 ♂ 21-10-33, 135 ♂ 24-10-33 Hamavas Lake; 315 ♂ imm. 5-12-33 Jawar, Jaswantpura.

Hume says of his specimens collected at Jodhpur that they are 'short-billed and green, closely approaching the *brevirostris* form'. He collected in a year of extreme drought which may have brought in birds from further west, but the specimens collected by the Survey appear to me to be closer to the typical form.

Chrysocolaptes festivus (Boddaert).

Adam collected a single specimen of the Black-backed Woodpecker in the Koochamun jungles.

Brachypternus benghalensis benghalensis (Linnaeus).

Specimens collected :—298 ♂, 300 ♂ 2-12-33 Jawar, Jaswantpura District.

These specimens of the Golden-backed Woodpecker definitely belong to the typical form. The bird is evidently not common as in the Sambhur area. Adam only saw one individual in the Koochamun jungles.

Dryobates mahrattensis aurocristatus (Tickell).

Specimens collected :—41-42 ♂♀ 12-10-33, 54 ♂ 14-10-33, 74 ♀ 16-10-33, 125 ♂ 22-10-33 Hamavas Lake; 266 ♂ 25-11-33, 289-290 ♂♂ 29-11-33, 299 ♂ 2-12-33 Sunda Hill, 3,400 ft., Jaswantpura.

Hume also procured the Yellow-fronted Pied Woodpecker near Jodhpur.

Jynx torquilla torquilla (Linnaeus).

Specimens collected :—31 ♀ 11-10-33, 73 ♂ 16-10-33, 89 ♂ 18-10-33 Hamavas Lake; 180 sex ? 5-11-33 Jalor; 274 ♂ 25-11-33, 284 ♀ 28-11-33 Sunda Hill, 3,400 ft.

Hume procured the Wryneck at Pali in April.

Xantholaema haemacephala indica Latham.

Specimen collected :—296 ♀ 29-11-33 Sunda Hill.

Hume records the Crimson-breasted Barbet from Jodhpur State.

Hierococcyx varius Vahl.

Hume includes the Common Hawk-Cuckoo in his Jodhpur list as a monsoon straggler.

Clamator jacobinus (Boddaert).

Hume says that the Pied Crested Cuckoo is only found in Jodhpur in the rains.

Eudynamis scolopaceus (Linnaeus).

The Koel is included by Hume in his Jodhpur list.

Centropus sinensis (Stephens).

The Crow-Pheasant is included by Hume in his Jodhpur list.

Taccocua leschenaultii sirkee (Gray).

Specimen collected :—60 ♀ 14-10-33 Hamavas Lake.

The ovary of this Sirkeer Cuckoo was much enlarged as if the bird was just about to lay. Adam considered the Sirkeer rare as he only met and procured a pair in a patch of jungle near Marot. Dr. King obtained the bird at Jodhpur in the rains.

Psittacula krameri manillensis (Bechstein)

No specimen of the Common Indian Roller was preserved by the Survey but Hume includes it in his Jodhpur list.

Psittacula cyanocephala (Linnaeus).

The Blossom-headed Parrakeet is included in Hume's Jodhpur list.

Coracias benghalensis (Linnaeus).

No specimen of the Common Indian Roller was preserved by the Survey but Hume includes it in his Jodhpur list.

Coracias garrula semenovi Loudon and Tschusi.

Specimen collected :—24 ♀ 10-10-33 Hamavas Lake.

An immature specimen of the Roller, evidently on passage.

Merops orientalis orientalis Latham.

Specimens collected :—233-234 ♂♂ 16-11-33 Bhinmal.

Hume remarks that the Little Green Bee-eater was 'scarce' near Jodhpur in January and February.

Merops superciliosus persicus Pallas.

Specimens collected :—97 ad. ♀, 98 juv. ♂ 19-10-33 Hamavas Lake, Pali.

According to Hume the Blue-cheeked Bee-eater is a summer visitor only to Jodhpur. Adam found it common in the Marot hills.

Ceryle rudis leucomelanura Reichenbach.

Hume includes the Pied Kingfisher in his Jodhpur list.

Alcedo atthis pallasii Reichenbach.

Specimen collected :—59 ♂ 14-10-33 Hamavas Lake.

This specimen of the Common Kingfisher is an adult in complete moult but it appears to belong to the above migratory race and not to the resident *bengalensis*.

Halcyon smyrnensis Linnaeus.

The White-breasted Kingfisher was not procured by the Survey. Hume met with it by some little tanks near Jodhpur, though he called it 'very rare'.

Upupa epops epops Linnaeus.

Specimen collected :—12 ♀ 8-10-1933, Pali.

Hume also noted the Hoopoe at Jodhpur.

Micropus affinis (Gray).

The Common Indian Swift is included by Hume in his Jodhpur list.

Caprimulgus europaeus unwini Hume.

Specimens collected :—36 ♂ 11-10-33, 50 [♀] 13-10-33, Hamavas Lake.

Asio flammeus flammeus (Pontoppidan).

Specimens collected :—273 ♀, 238 ♂ 17-11-33, Bhinmal.

Strix occellata (Lesson).

Specimen collected :—312 ♂ 5-10-33 Jawar, Jaswantpura.

Ketupa zeylonensis leschenaulti (Temminck).

The Fish-Owl was not procured by the Survey but Hume saw and collected a single specimen near Jodhpur.

Bubo bubo bengalensis (Franklin).

Specimens collected :—85 ♀ 17-10-33 Hamavas Lake; 359 ♂ 12-1-34 Pichiak Lake, Bilara.

Hume considered the Rock Horned Owl rare in Jodhpur.

Bubo coromandus (Latham).

Specimen collected :—356 ♂ 12-1-34 Pichiak Lake, Bilara.

The Dusky Eagle-Owl is included in Hume's list.

Athene brama indica (Franklin).

Specimens collected :—20 ♂ 10-10-33 Hamavas Lake; 326 ♂ 21-12-33 Tilwara.

Hume met with the Spotted Owlet near Jodhpur.

Sarcogyps calvus (Scopoli).

Hume met with the King Vulture near Jodhpur and Adam mentions a rock nest in March in the hills near the town of Nawa.

Gyps fulvus fulvescens Hume.

Hume shot the Indian Griffin himself at Jodhpur.

Gyps indicus pallescens Hume.

Also procured by Hume at Jodhpur where it is apparently common. No specimens of Vultures were preserved by the Survey.

Pseudogyps bengalensis (Gmelin).

Noted by Hume near Jodhpur and apparently common.

Neophron percnopterus ginginianus (Latham).

The Egyptian Vulture is very common in Jodhpur State. Hume records it as of this form.

Falco jugger Gray.

Specimens collected :—307 ♂ 4-12-33 Jawar, Jaswantpura ; 327 ♂ 21-12-33 Tilwara.

Hume met with the Lugger Falcon at Balmeer and Jodhpur but considered it rare.

Falco checquera Daudin.

The Torumti was noted by Hume near Jodhpur but no specimen was procured by the Survey.

Falco tinnunculus tinnunculus Linnaeus.

Specimen collected :—203 ♀ 8-11-33, Jalor.

Hume called the Kestrel rare in the neighbourhood of Jodhpur.

Aquila rapax vindhiana Franklin.

Spcimens collected :—149 ♂ 1-11-33 Jalor ; 228 ♀ 15-11-33 Bhinmal ; 317 ♀ 6-12-33 Jawar, Jaswantpura ; 325 ♂ 20-12-33 Tilwara.

Hume also records the Tawny Eagle from the neighbourhood of Jodhpur.

Aquila clanga Pallas.

Specimen collected :—360 ♀ imm. 14-1-34 Pichiak Lake, Bilara District.

The Large Spotted Eagle is included by Hume in his Jodhpur list.

Hieraëtus fasciatus fasciatus (Vieillot).

Specimen collected :—361 ♀ 14-1-34 Pichiak Lake, Bilara District.

Hume had a specimen of Bonelli's Eagle from the State.

Circaëtus ferox (S. G. Gmelin) [*gallicus* auct.].

Hume states that he took the nest and saw several specimens of the Short-toed Eagle in Jodhpur. For the change of the name of this Eagle see *Ibis*, 1934, p. 645.

Butastur teesa (Franklin).

Specimens collected :—311 ♂ 4-12-33 Jawar, Jaswantpura ; 236 ♂ imm. 16-11-33 Bhinmal.

The White-eyed Buzzard is included by Hume in his list.

Haliaëtus leucoryphus (Pallas).

Pallas' Fishing Eagle is said by Hume to occur in Jodhpur but it is necessarily rare there.

Milvus migrans govinda Sykes.

No specimen of the Common Pariah Kite was brought back by the Survey but Hume includes the bird in his Jodhpur list and it is presumably common.

Elanus caeruleus vociferus (Latham).

Specimen collected :—171 ♂ 4-11-33 Jalor.
Included by Hume in his Jodhpur list.

Circus macrourus (S. G. Gmelin).

Specimen collected :—277 ♀ 26-11-33 Sunda hill, 3,400 ft.
The Pale Harrier is said by Hume to be common.

Circus aeruginosus aeruginosus (Linnaeus).

Specimen collected :—357 ♂ 10-1-34 Bilara.
Also said by Hume to be common but suitable jheels are scarce in the State.

Buteo rufinus rufinus (Cretzschmar).

Specimens collected :—322 ♀, 324 ♂ 19-12-33 Tilwara.
Hume found the Long-legged Buzzard 'rather scarce' in the neighbourhood of Jodhpur.

Buteo buteo burmanicus Hume.

Specimens collected :—255 ♂ 23-11-33, 282 ♂ 27-11-33 Sunda Hill, 3,400 ft.
In attributing these two Buzzards to the above race I am following conventional usage rather than any profound conviction of my own as the whole question of the identity of Indian Buzzards seems to be uncertain. No. 282 is the smallest Buzzard I have ever seen (bill from skull 32.5, wing 342, tail 182 tarsus 7.5 mm.) and smaller than the measurements given by Witherby for *vulpinus* (♂ wing 350-85 mm.) and by Hartert for *japonicus* (=*burmanicus*) (♂ wing 355-87 mm.). It seems to me equally likely to belong to either form. It will be remembered that Hume was very puzzled by a small Buzzard with a wing of 13.4 ins.=340 mm. obtained on the Brahmagherries. *S.F.*, x, pp. 159, 327 and 338.

Astur badius dussumieri (Temminck).

Specimens collected :—181 ♂ 6-11-33 Jalor; 213 ♀ 13-11-33 Bhinmal.
Hume records the Shikra from Jodhpur but considered it local and absent from the more barren areas.

Accipiter nisus (Linnaeus).

Hume says that the Sparrowhawk occurs in Jodhpur but is apparently very rare.

Crocopus phoenicopterus chlorogaster (Blyth).

The Southern Green Pigeon is stated by Hume to occur in Jodhpur.

Columba livia subsp.

No specimen of the Blue Rock-Pigeon was procured by the Survey. Under the name of *intermedia* Hume stated that he found this species extraordinarily scarce in Jodhpur even though its killing was strictly forbidden. This was in a year of drought and he was informed that it was more common in normal years.

Streptopelia senegalensis cambayensis (Gmelin).

Streptopelia chinensis suratensis (Gmelin).

Streptopelia decaocto decaocto Frivalsky.

Oenopopelia tranquebarica tranquebarica (Hermann).

No specimens of doves were preserved by the Survey but Hume includes these four species in his Jodhpur list.

Pterocles orientalis (Linnaeus).

The Imperial Sandgrouse is said by Hume to be very common in Jodhpur and he describes (*Game Birds*, i, 49) how he came upon a pack of fully two thousand, grouped together in a clump little, if at all, more than thirty yards long by ten wide.

Pterocles indicus (Gmelin).

Adam found the Painted Sandgrouse common in the Koochamun Hills in March 1871 and gives a full account (*S.F.*, i, 391) of how he shot them over water there. He subsequently obtained eggs from that locality in April and May.

Pterocles alchata caudacutus (S. G. Gmelin).

According to Stuart Baker (*Game Birds*, ii, 283) the Large Pin-tailed Sandgrouse has been obtained in Jodhpur but no details are given.

Pterocles exustus ellioti Bogdanow.

The Common Sandgrouse is common in Jodhpur according to Hume.

Pterocles senegallus (Linnaeus).

Dr. Newman obtained the Spotted Sandgrouse at Pokurun and found it very common between that place and the town of Jaisalmer as well as throughout the country for about 20 miles south of Jaisalmer. This tract is hard and stony but intermingled with sand. A male skin and the wing of a female were sent to Butler in verification of this record (cf. *S.F.*, iv, 508 and v, 60).

Pavo cristatus Linnaeus.

In spite of the drought and famine Hume found a few Peafowl still at Jodhpur and he remarks that as the bird is more or less sacred in Rajputana it becomes very common wherever there is suitable cover.

Perdicula argoondah meinertzhageni Whistler.

Specimen collected :—169 ♀ 4-11-33 Jalor, 500 ft.

The Rock Bush-quail is said by Hume to be common. Either this or *P. asiatica* occurs in the Koochamun Hills.

Francolinus pondicerianus (Gmelin).

Included by Hume in his Jodhpur list.

Coturnix coturnix (Linnaeus).

In Hume's Jodhpur list.

Coturnix coromandelica (Gmelin).

According to Hume the Black-breasted quail is found in western Jodhpur only in the rains.

Turnix tanki tanki Blyth.

Hume states that the Button-quail has been obtained in Jodhpur towards the close of the rains in August and September.

Turnix sylvatica dussumieri (Temm. & Lang.).

The Little Button-quail is included by Hume in his Jodhpur list.

Gallinula chloropus (Linnaeus).

The Waterhen is given in Hume's list.

Porphyrio poliocephalus (Latham).

Very rare in Jodhpur (Hume).

Fulica atra Linnaeus.

Given in Hume's list.

Hydrophasianus chirurgus (Scopoli).

Given in Hume's list.

Rhynchaea benghalensis (Linnaeus).

Occurs in Jodhpur according to Hume but is more common in the rains.

Grus grus (Linnaeus).

The Common Crane is more or less common in the cold season according to Hume.

Antigone antigone (Linnaeus).

Common in Jodhpur according to Hume.

Anthropoides virgo (Linnaeus).

The Demoiselle is common in Jodhpur according to Hume. Adam mentions seeing a flock near Nawa on 13 March 1873.

Choriotis nigriceps (Vigors).

In Hume's day the Great Bustard was 'uncommon' in Jodhpur.

Chlamydotis undulata macqueenii (Gray)

Common in Jodhpur (Hume).

Sypheotides indica (Miller).

Common in Jodhpur as a rain's visitor according to Hume.

Burhinus oedicnemus saharae (Reichw).

Specimen collected :—96 ♂ 19-10-33 Hamavas Lake, Pali.

Adam says that he met with the Stone-curlew in the scrub jungle near to Mata Pahar and in the low range of hills to the west of Nawa; in the latter place he saw a party of four. Mack-worth-Praed and Grant (*Ibis.*, 1936, p. 200) have come to the same opinion which I reached independently that *saharae* and *astutus* are only sandy and greyish phases of the same bird, phases which Ticehurst has suggested (*Ibis.* 1937, pp. 406-407) may have some connection with soil and locality as in the case of various larks. Bates' suggestion (*Ibis.*, 1937, p.308) that the sandy phase was connected with immaturity is refuted by this specimen which is very sandy in colour and is an adult undergoing the complete post-nuptial moult.

Esacus recurvirostris (Cuvier).

The Great Stone Plover is found in suitable river beds in Jodhpur (Hume).

Cursorius cursor (Latham).

According to Hume the Cream-coloured Courser replaces the next species throughout the greater part of Jodhpur.

Cursorius coromandelicus (Gmelin).

Hume notes that he saw the Indian Courser near Jodhpur town.

Larus brunneicephalus Jerdon.

Chlidonias leucopareia indica (Stephens).

Gelochelidon nilotica (Gmelin).

Sterna aurantia Gray.

Hume notes that these 4 species occur in Jodhpur.

Squatarola squatarola (Linnaeus).

'In Jodhpur I do not know of its occurring except when migrating in autumn and spring when stragglers are met with at many large pieces of water' (Hume).

Leucopolius alexandrinus (Linnaeus).

Included on Hume's authority.

Charadrius dubius jerdoni (Legge).

Specimen collected :—5 ♂ 8-10-33 Pali.
According to Hume the Little Ring Plover is common in Jodhpur.

Cirrepedesmus mongolus (Pallas).

Cirrepedesmus leschenaultii (Lesson).

According to Hume both these Plovers may be met on migration in Jodhpur between 15 August and 15 September or during April and May.

Pluvialis dominicus fulvus (Gmelin).

Hume states that he has only seen one specimen of the Eastern Golden Plover from Jodhpur and that was taken at Pali.

Vanellus vanellus (Linnaeus).

Adam says that he only saw the Lapwing twice at a lake near Koochamun and only obtained one specimen.

Chettusia gregaria (Pallas).

A cold weather visitor and common according to Hume.

Chettusia leucura (Lichtenstein).

Included in Hume's list.

Lobivanellus indicus (Boddaert).

Although the Red-Wattled Lapwing was not procured by the survey it is common in Jodhpur according to Hume and during the drought he found a pair or two about every hamlet. The little village ponds, around which these birds usually live, were then empty and Hume describes in amusing language how they had in consequence betaken themselves to the village Golgathas, living on the maggots and the flesh of the carcases of dead animals.

Himantopus himantopus (Linnaeus).

Common (Hume).

Recurvirostra avocetta Linnaeus.

Comparatively rare in Jodhpur (Hume).

Numenius arquata Linnaeus.

Rare in Jodhpur where the localities suited to it are few (Hume).

Limosa limosa (Linnaeus).

Common according to Hume.

Tringa stagnatilis (Bechstein).

Not uncommon in suitable localities in Jodhpur (Hume).

Tringa glareola Linnaeus.

Tringa totanus (Linnaeus).

Tringa erythropus (Vroeg).

Glottis nebularia (Gunnerus).

These four species are all included by Hume in his list.

Philomachus pugnax (Linnaeus).

The Ruff is common according to Hume.

Erolia minuta (Leisler).

Erolia temminckii (Leisler).

Both these Stints are included in Hume's list.

Capella gallinago (Linnaeus).

Lymnocryptes minutus (Brünnich).

Both these Snipe are included in Hume's list, the former being said to be common.

Pelicanus philippensis Gmelin.

Hume includes the Spot-billed Pelican in his Jodhpur list.

Phalacrocorax carbo (Linnaeus).

Included in Hume's list.

Phalacrocorax fuscicollis Stephens.

Dr. King noted the Indian Shag from Jodhpur but Hume says that he personally had not examined any specimen from there.

Phalacrocorax niger (Vieillot).

Said by Hume to be common in suitable localities.

Anhinga melanogaster Pennant.

Included in Hume's list.

Platalea leucorodia Linnaeus.

Threskiornis melanocephalus (Latham).

Pseudibis papillosus (Temm. & Laug.).

All three species are included by Hume in his list apparently as more or less common birds.

Plegadis falcinellus (Linnaeus).

'Very rare in Jodhpur' (Hume).

Ciconia ciconia (Linnaeus).

Hume did not think the White Stork was very rare in parts of Jodhpur suited to its tastes.

Ciconia nigra (Linnaeus).

The Black Stork has been obtained in Jodhpur (Hume).

Xenorhynchus asiaticus (Latham).

Rare in Jodhpur (Hume).

Leptoptilos dubius (Gmelin).

Hume says that the adjutant in his day was scarcely seen in Jodhpur except during the rains, but I imagine that it is no longer found there.

Ibis leucocephalus (Pennant).

Common in Jodhpur according to Hume.

Anastomus oscitans (Boddaert).

Hume says that the Open-bill is not uncommon in Jodhpur.

Ardea purpurea Linnaeus.

Ardea cinerea Linnaeus.

Egretta alba (Linnaeus).

Egretta garzetta (Linnaeus).

Bubulcus ibis coromandus (Boddaert).

Ardeola grayii Sykes.

Butorides striatus javanicus (Horsfield).

Nycticorax nycticorax (Linnaeus).

All the above species of Heron are included by Hume in his Jodhpur list.

Phoenicopterus ruber Linnaeus.

According to Hume Dr. King obtained the Flamingo at Pali in October.

Sarkidiornis melanotus (Pennant).

The Nukta is common in Jodhpur according to Hume.

Dendrocygna javanica (Horsfield).

Very rare in Jodhpur (Hume).

Casarca ferruginea (Pallas).

Occurs in Jodhpur (Hume).

Anas platyrhyncha (Linnaeus).

'I have only seen one killed in Jodhpur near Pallae' (Hume).

Anas poecilorhyncha Forster.

Chaulelasmus streperus (Linnaeus).

Nettion crecca (Linnaeus).

Dafila acuta (Linnaeus).

Querquedula querquedula (Linnaeus).

Spatula clypeata (Linn.).

Netta rufina (Pallas).

Nyroca ferina (Linnaeus).

Nyroca rufa (Linnaeus).

Nyroca fuligula (Linnaeus).

The above ducks are all included by Hume in his Jodhpur list.

Podiceps ruficollis capensis Salvadori.

Finally the Little Grebe is also included by Hume in his Jodhpur list.

ON A NEW COCCIDIUM *ISOSPORA MINUTA* n. sp. FROM THE INTESTINE OF A COBRA *NAJA NAJA* LINN.

BY

Matiranjan Das-gupta, m.sc.

(*From the Dept. of Zoology, University of Calcutta*).

(*With three text-figures*).

Introduction.

In July 1935, some specimens of Cobra *Naja naja* bought from local dealers who captured them from Sunderbans, Bengal, were examined. Oocysts of a coccidium belonging to the genus *Isospora,* were directly recovered from the natural droppings and rectal contents on dissection of some of the specimens kept in captivity. From the literature on the subject the following species of *Isospora* from snakes are found to have been recorded:— *Isospora* sp. Grassi (1881) from *Coronella austriaca*; *I. laverani* Hagenmuller (1898) from *Coelopeltis lacertina; I. fragilis* Leger (1904) from *Vipera aspis; I. crotali* (Triffitt, 1925) Hoare from *Crotalus confluentus; I. neivai* Pinto and Maciel (1929) from *Bothrops jararaca; I. naiae* Fantham (1932) from *Naja flava; I. dirumpens* Hoare (1933) from *Bitis arietans; I. phisalix* Yakimoff and Gousseff (1934) from *Elaphe quatuor lineata sauromotes; I. lenti* Pinto (1934) from *Bothrops jararaca.*

The development of the oocysts of this coccidium took place outside the body of the host and thus it differs from *I. dirumpens* Hoare in which the oocysts become mature in the wall of the intestine (intra and sub-epithelial regions). It also differs from *I. naiae* Fantham by the absence of oocystic residue and the presence of sporocystic one. This parasite obtained from cobra differs from other known species of *Isospora* from snakes by its shape, size and nature of the oocysts and the name *Isospora minuta* n. sp. is proposed for it.

Material and Methods.

Rectal contents diluted with saline was examined systematically in sealed preparations. The oocysts were transferred to 1 per cent chromic acid solution where the development was completed in three days. Portions of the intestine were fixed in Buin's fluid and then cut sections 6 μ thick and stained in Heidenhain's hæmatoxylin. Measurements of oocysts were taken from samples both fresh and in chromic acid solution.

Observations on *Isospora minuta* n. sp.

In the sub-epithelium of the sections of the intestine oocysts were found with two sporocysts containing ripe sporozoites (Fig. 1).

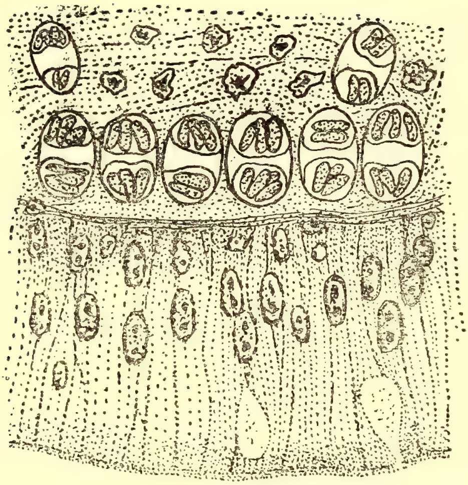

Fig. 1

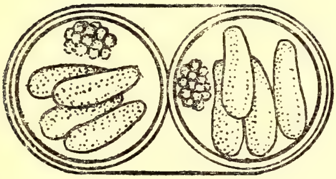

Fig. 2

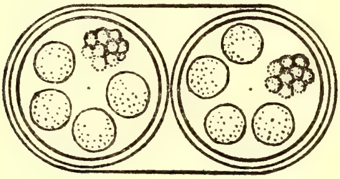

Fig 3

Isospora minuta n. sp.
(*For explanation see end of article*).

No other endogenous stages were observed. The fully matured oocysts in chromic acid solution measure 15 × 7.5 μ (Fig. 2). The oocystic membrane is very thin and there is no oocystic residue. The two thick-walled sporocysts (Fig. 3) are spherical and measure 7.5 μ in diameter. A small sporocystic residue is present. The sporozoites are arranged in a regular manner and lie on one side of the small sporocystic residue. The presence of innumerable mature oocysts in the sub-epithelium and the total absence of a single ripe oocyst or any sporocysts in the fæces and the absence of the other endogenous stages of the parasite may be accounted for. In one stage in the life of this parasite the ripe sporozoites by rapturing the sporocystic wall, may infect the neighbouring cells and then by some of them oocysts are formed which come out with the fæces to infect a new host.

Diagnosis.— Systematic position *Isospora minuta* n. sp. (Coccidiida, Eimeriidae).

Oocysts very small, thin-walled, development extra corporal, no oocystic residue; sporocyst spherical, thick-walled; small sporocystic residue present; unsegmented oocysts discharged from host; sporulation time 3 days.

Habitat.—Small intestine of cobra *Naja naja.*

Locality.—Sunderbans, Bengal.

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EXPLANATIONS OF FIGURES.

All the drawings were made under camera lucida.

1. Section of intestine with sporoblasts containing sporozoites. ×750.
2. Mature thin-walled oocyst with two thick-walled spherical sporoblasts. ×2700.
3. Oocyst with two sporoblasts each containing 4 ripe sporozoites and a small residue. ×2700.

THE BIRDS OF RAMESWARAM ISLAND.

BY

C. H. BIDDULPH

(*With a map*).

Rameswaram Island, situated at the southern end of the Ramnad District in the Madras Presidency and forming the Indian end of Adams Bridge between India and Ceylon, is of importance, other than as regards the bird life which is found on it. Besides being a spot venerated by Hindus it is the terminus, at the Indian end, of the Indo-Ceylon rail connection between Dhanushkodi and Talaimannar.

The island, which is roughly triangular in shape, is approximately seventeen miles in length and seven miles in width at the widest part. It is separated from the mainland of India by the Pamban Pass which is something over a mile in width and is bridged to enable trains to cross over to the island and proceed to the rail terminus at Dhanushkodi.

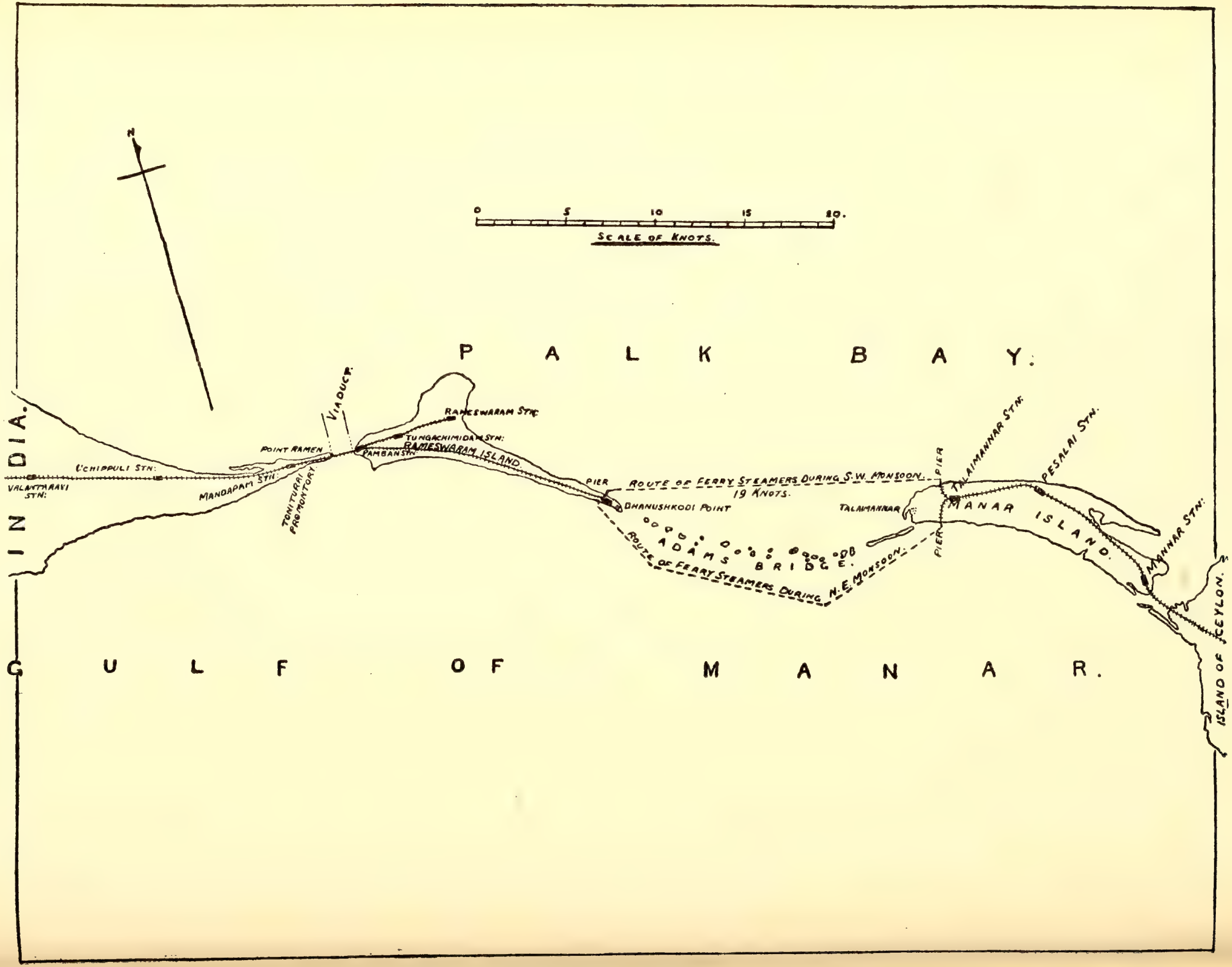
The northern half of the island is really the only portion with any appreciable width and elevation above the sea and is sparsely covered with trees and vegetation, the vegetation being thicker where the swamps and backwaters occur. Practically the entire southern half consists of bare sandy plains and sand hills, which are continually moving during the heavy seasonal winds. The vegetation in this area consists of a few babool trees with coarse grasses and a few stunted bushes.

The common trees are the tamarind, neem, casuarina and mango with coconut and palmyrah palms. All the above have been planted by the inhabitants of the island. The remaining vegetation, which has not been cultivated, consists of babool trees, dwarf date palms, screwpine, various thorn bushes, creepers, mangrove in the swampy areas, cactus in the drier areas and various varieties of coarse grasses, which in some parts cover considerable areas.

All the commoner birds are found in the northern, or wooded half of the island, whereas the southern half is admirably suited to the Plovers, Gulls, Terns, Flamingoes and Waders. The Flamingoes are restricted to the extreme southern end of the island, where it tapers to a point and the low-lying sand flats become shallow lagoons during the north-east monsoon.

Apart from the bird life the island is singularly devoid of animals, squirrels and mongooses only being seen. The only reptiles observed were the common bloodsucker and a few rat and water-snakes.

The sea surrounding the island is one of the few areas in which the Dugong is found and occasionally caught by the fishermen. Turtles, both Green and Hawk-billed, are also caught in fairly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SCALE OF KNOTS.
PALK BAY.
GULF OF MANAR.
INDIA.
VALANTHARAVI STN:
UCHIPPULI STN:
MANDAPAM STN:
POINT RAMEN
TONITURAI PROMONTORY
VIADUCT.
PAMBAN STN:
TUNGACHIMIDAM STN:
RAMESWARAM STN:
RAMESWARAM ISLAND.
PIER
DHANUSHKODI POINT
ROUTE OF FERRY STEAMERS DURING S.W. MONSOON.
19 KNOTS.
ADAMS BRIDGE.
ROUTE OF FERRY STEAMERS DURING N.E. MONSOON.
TALAIMANNAR
PIER
PIER
TALAIMANNAR STN.
MANAR ISLAND.
PESALAI STN.
MANNAR STN.
ISLAND OF CEYLON.

Birds of Rameswaram Island.

large numbers; the former for food and the latter for the tortoise shell.

The average rainfall for the past sixty years is 36.81 inches, of which 27.90 inches is accounted for during the north-east monsoon in October, November and December. June, July and August are the driest months of the year, the rainfall being under an inch per month during this period.

The heavy winds at the time of the south-west monsoon are responsible for a great deal of the drifting sand which forms big sand-dunes which move from west to east across the island until anchored by encountering trees and being covered by a growth of grasses and shrubs.

The island is fairly healthy except for malarial fever which is prevalent at certain seasons of the year.

The main occupation of the inhabitants is fishing and fish curing, the salted fish being exported to Ceylon. This occupation has a direct bearing on a certain section of the bird life. At this season there is a large influx of Pariah Kites, Brahminy Kites, Common Crows and Jungle Crows from the mainland. They can then be seen in large numbers where the fish are spread out to dry. These birds are seen each morning flying over from the mainland and returning again in the evening. These non-resident birds do not appear to consider the island a home, or even a temporary home, during this period as they return to the mainland each night.

Observations of the bird life extended over the period June 1929 to May 1931, records being maintained of all the resident species, local migrants and true migrants for each month of the year.

The list of birds furnished is not to be considered as complete, but covers only such birds as were readily seen during the two-year period under review. Such birds as the Golden Oriole, Coppersmith and Spoonbill have been reported to occur, but have not been included as they were not observed by me. Attention was directed mainly to the water birds because of the restricted area in the Presidency where their movements could be studied under such favourable conditions. These birds appear to find the island admirably suited to their requirements, both as a permanent or semi-permanent feeding ground, as also a convenient resting place on their journeys through India to Ceylon and back again at the end of the north-east monsoon.

It will be observed that certain of the waders have been recorded in practically every month of the year and it is presumed that such of them as are seen during the summer months are non-breeding birds that have found conditions on the island suitable and have remained, when the majority have left for their breeding grounds in Central Asia and Siberia.

The list of birds shows that the permanent bird population consists of only the commoner birds seen on the plains of the mainland of India, but there appears to be scope for a detailed examination of all the resident birds, as also the local migrants, as there would be every possibility of finding intermediate races between the true Indian and Ceylon forms on the island.

It is regretted that a series of skins of all the birds under these classes was not secured at the time, as a detailed paper was not contemplated with a view to establishing the existence of local races, but merely to cataloguing the number of species found on this small island. This paper may be considered as an introduction to a more detailed examination of the resident bird life on the island by an investigator with more time at his disposal, who can obtain a series of skins for comparison with collections of skins from India and Ceylon already available in the British Museum collection.

A perusal of the articles in the Bombay Natural History Society's *Journal*, in connection with the 'Vernay Scientific Survey of the Eastern Ghats', shows that considerable information is still required in connection with some of the commonest birds found in the Madras Presidency. It is hoped that information furnished against some of the species found on Rameswaram Island may in a measure supplement what has so far been placed on record. In Volume xxxv, No. 3, page 505 of the *Journal*, in the first article in connection with the Survey the attention of members has been drawn to this lack of knowledge and it is felt that although Rameswaram Island lies outside the actual area of the Eastern Ghats that it is still one of the interesting areas where careful bird-watching will result in clearing up some of the problems before investigators interested in a detailed study and comparison of the birds of India and Ceylon.

The only other reference to a study of the bird life of Rameswaram Island which I have been able to find, through references given in the published accounts of the Vernay Scientific Survey, is a list of twenty-four birds secured by Doctor Armstrong near Pamban in March 1875. The skins of these birds were sent to Hume and published in *Stray Feathers*, 1876, pp. 457-459. Twenty-three of these birds have been marked with an asterisk in the list of birds now furnished.

One bird, *Otocompsa emeria fuscicaudata,* appears unusual as it was never seen on the island by me and is practically a permanent resident in the hills. It may be presumed that the bird secured was a very rare stray migrant or else an escaped cage-bird which had been brought to the island.

I have to acknowledge reference to the *Manual of the Birds of Ceylon* by W. E. Wait of the Ceylon Civil Service, from which I have quoted in certain instances where it is thought that observations recorded in the case of the Ceylon birds confirmed those of the birds from Rameswaram Island; or accounted for certain uncommon birds which may have come, or been blown over from Ceylon during the monsoons.

I have also to acknowledge the valuable assistance and advice given me by Mr. N. B. Kinnear, M.B.O.U., of the British Museum of Natural History, South Kensington, in the preparation of this paper. It was with his permission that I was able to consult reference books in the Museum Library and study the valuable collection of birds' skins secured by the collectors of the Vernay Scientific Survey of the Eastern Ghats of the Madras Presidency.

In this paper Rameswaram Island has been considered as lying with its longest length due north and south; actually the map shows that it lies almost due east and west. It is however not considered sufficiently important to alter the notes to agree with its actual situation.

The Jungle Crow *Corvus macrorhynchos culminatus* (Sykes).

A common bird seen everywhere on the island. Greater numbers are seen during the months of May and June and again in August and September when fish curing operations are in progress.

A pair of these birds were seen building a nest on a palmyrah palm on 12-6-1930.

The Common House Crow *Corvus splendens splendens* (Vieillot).

A common bird seen everywhere on the island. As in the case of the Jungle Crow much larger numbers are observed on the island during the months of May and June and August and September.

The birds breed freely on the island and five nests were seen in June 1929. Coconut palms were used in two instances, casuarina trees in two instances and one nest in a tamarind. In one case the nest was only 9 feet off the ground in a casuarina tree. In every instance the birds were sitting on the nests and four eggs were taken from one of the nests in a coconut palm on 11-6-1929. Three of the eggs were heavily incubated but the fourth. which was much smaller, was practically fresh and was thought to be that of a Koel. It will be noticed however that Koels have only been observed on the island during the months of October, November and December.

Crows were again seen building in September and on 1-10-1930 a nest with young was seen in the steel lattice jib of the pier crane at Dhanushkodi.

Baker and Inglis in *The Birds of Southern India* give the breeding season of the Crow as February to August.

***The White-headed Babbler** *Turdoides striatus polioplocamus* (Oberholser).

A common bird found in the northern half of the island. These birds are more in evidence during the months of July, August and September.

***The Common Babbler** *Argya caudata caudata* (Dumont).

A fairly common bird, but not nearly so common as the preceding species. They are seen in small parties, in every month of the year, in the northern half of the island.

***The Ceylon Iora** *Ægithina tiphia zeylonica.*

A fairly common bird in the northern half of the island. The birds seen are generally very dark in colour and are almost certainly the Ceylon Iora, although this matter cannot be settled satisfactorily until a series of skins has been examined.

The Red-vented Bulbul *Molpastes cafer cafer* (Linn.).

A common bird seen in the northern half of the island. These birds are more in evidence during the months of November, December, January and February.

The Yellow-browed Bulbul *Iole icterica* (Strickland).

A fairly common bird seen moving about the undergrowth, in small parties, in the northern half of the island. The numbers seen are fairly constant for every month of the year.

A bird was shot on 29-9-1930 for purposes of identification.

The Black-backed Indian Robin *Saxicoloides fulicata fulicata* (Linn.).

A rare bird on the island as a male of this species was only once seen on 31-1-1930.

It is reported as abundant all over the low country in Ceylon and may have been a stray bird blown over during the heavy winds of the north-east monsoon.

***The Magpie Robin** *Copsychus saularis ceylonensis.*

A very uncommon bird only seen on two occasions in May and August. On each occasion only a single bird was seen in the northern half of the island.

Hume however had a skin which was obtained from Pamban in March 1875.

The Red-breasted Flycatcher *Siphia parva albicilla.*

A rare bird seen during the month of October near Rameswaram town in the thick babool scrub jungle. Four birds were seen on the same day.

It is suggested in the account of the 'Vernay Scientific Survey of the Eastern Ghats' that this bird should be omitted from the Madras Presidency list. I am of the opinion however that it should be considered one of the Presidency birds as it has been frequently seen by me in the Villupuram, Tanjore and Madura Districts during the winter months.

Wait remarks that it would appear to migrate down the centre of the Indian peninsula and that it has been observed in the Deccan in October.

***The Paradise Flycatcher** *Tchitrea paradisi paradisi* (L.).

A fairly common bird seen in the northern half of the island in gardens near dwellings at Pamban. Usually seen during the months of October, November, December and January. I have a single record of one seen on 29-3-1930, which appears to be late for the island.

None of the pure white and black males were observed, nor did any of the males have the median chestnut tail feathers fully developed.

Reported by Wait as only being seen in its white and black plumage on one occasion although a common resident bird in Ceylon.

The Bay-backed Shrike *Lanius vittatus* (Valenciennes).

A fairly common bird seen in the northern and central portions of the island where it was drier and babool trees and thorn bushes were found. The numbers appear to increase during the months of July, August and September.

The Grey-backed Shrike *Lanius schach caniceps* (Blyth).

A fairly common bird which is seen in the same areas as the preceding one, but not in the same numbers. My notes do not record the bird in the month of September, but this may be due to the one or two birds usually seen being in some other part of the island during that month.

***The Common Wood Shrike** *Tephrodornis pondicerianus pondicerianus* (Gmelin).

An uncommon bird on the island, three being the greatest number seen on a single day. Usually found in the same area as the two preceding species.

My records show that these birds were not observed on the island during the months of March, April and May and again in November and December.

Hume records this bird from the island in March 1875. There appears to be no reason why it should not be resident.

The Large Indian Cuckoo Shrike *Graucalus javensis macei* (Lesson).

An uncommon bird only seen during the months of January and February and in a single instance one was observed in October.

Three birds was the largest number seen on any single day. It is possible that the birds seen on the island were the Ceylon type *Graucalus macei layardi.*

***The Ashy Swallow Shrike** *Artamus fuscus* (Vieillot).

A fairly common bird which is seen almost everywhere on the island where palmyrah palms are growing. These birds are very numerous during the period June to September, the numbers falling off considerably during the remaining months of the year. The fewest birds are seen during the period January to March.

Reported as appearing to be a partial migrant in parts of Ceylon.

***The Black Drongo** *Dicrurus macrocercus peninsularis* (Ticehurst).

A common bird seen over the greater part of the island. The numbers appear to increase during the period June to September and it is during the latter month that numbers of young birds are seen without their long outer tail feathers. The breeding season on the island would therefore agree with that shown by Baker and Inglis in *The Birds of Southern India.*

Some of the drongos on the island should be shot and examined as it is possible that the Ceylon Black Drongo may also occur.

***The Indian Tailor Bird** *Orthotomus sutorius guzurata* (Latham).

A bird which is not seen in any numbers due to its skulking habits and size. Birds were seen in every month of the year excepting November and December and this may have been due to the fact that they were keeping under cover during the north-east monsoon.

The Ashy Wren-warbler *Prinia socialis socialis* (Sykes).

This bird was not seen during the period February to May. It is never really common and three is the greatest number seen on any single day.

The Rosy Pastor *Pastor roseus* (Linn.).

These birds only visit the island during the winter months when they are seen in small flocks during December, January and February. Most birds are seen in the month of December.

It is thought that these birds are migrants on their way to Ceylon that spend as short a time as possible on the island due to the scarcity of suitable food.

Reported as a rather uncertain migrant to the north and west of the island of Ceylon.

***The Brahminy Mynah** *Temenuchus pagodarum* (Gmelin).

These birds only visit the island during the winter months. The scattered birds collect into small parties which are seen flying about in December and January. Usually seen in the northern and central parts of the island. No birds are seen during the period April to September.

The Common Mynah *Acridotheres tristis tristis* (Linn.).

A common bird seen practically all over the island.

A pair of these birds were seen entering a nest in a hole in a palmyrah palm on 21-6-1930.

The White-throated Munia *Uroloncha malabarica* (Linn.).

This bird was not seen during the summer months of April to September. A few were however seen on one occasion in June 1929.

The greatest number seen together was twelve, the usual being three or four birds. It cannot be considered to be a common bird on the island.

The Yellow-throated Sparrow *Gymnorhis xanthocollis xanthocollis* (Burton).

Seen on only one occasion on the island on 19-2-1931.

Reported as a mere straggler to Ceylon.

The House Sparrow *Passer domesticus indicus* (Jardine and Selby.).

A very common bird which is found wherever there are dwellings on the island. They have gathered in large numbers even at the extreme end of the island and nest in the verandahs of the Post Office building at Dhanushkodi during July and August. Large numbers also breed in dwellings at Pamban and Rameswaram town.

The Grey-headed Wagtail *Motacilla flava thumbergi* (Billberg).

A fairly common bird found on the island from September to March each year. They are never seen in great numbers and are usually found near the railway line in the lower and more sandy part of the island, frequenting the railway borrow-pits which contain water.

These birds are commonest during January and February, when from twenty to thirty may be seen in a single day.

It is observed in the account of the 'Vernay Scientific Survey' that it is suggested that these wagtails may reach Ceylon by way of the Andaman Islands. This is not considered by me to be the usual route as large numbers are seen during the period December to February, in the Tanjore District, which appear to be migrating. In some instances, especially in the evenings, flights consisting of from two to three hundred birds were seen resting on house tops and even on large trees before resuming their flight at sunset.

Reported as one of the commonest migrants arriving in Ceylon in September and abundant during the north-east monsoon.

***The Indian Pipit** *Anthus rufulus rufulus* (Vieillot).

A bird which is never really common, although a greater number are seen in December, January and February. This pipit is usually found in the southern half of the island where there are large areas of very flat land covered with coarse grasses.

The Madras Bush-lark *Mirafra affinis* (Jerdon).

A fairly common bird which is found practically all over the island, but more especially in the area referred to when dealing with the pipit.

There does not appear to be a period in the year when they are more numerous.

Sykes' Crested Lark *Galerida deva* (Sykes).

A fairly common bird which is found in the southern half of the island where there are large areas of level grass land.

Birds were not actually observed in May and November, but it cannot be assumed that they leave the island for two short periods in the year.

The Rufous-tailed Finch-lark *Ammomanes phoenicura phoenicura* (Franklin).

A fairly common bird which visits the island during the period May to October. It is usually found in the southern half of the island, although not entirely confined to that area as it is frequently seen along the railway line in the northern half. The largest numbers were seen in the months of July and October.

***The Ashy-crowned Finch-lark** *Eremopterix grisea grisea* (Scopoli).

A very common bird seen practically all over the island during every month of the year. Larger numbers appear to be seen during the period October to January.

***The Indian Purple Sunbird** *Cinnyris asiatica asiatica* (Latham).

A fairly common bird which is confined to the northern half of the island. Has not been observed breeding on the island although it must do so.

The Purple-rumped Sunbird *Cinnyris zeylonica* (Linn.).

A fairly common bird which is confined to the northern half of the island. More birds appear to be seen during the months of July, August and September.

Baker and Inglis in *The Birds of Southern India* state that the breeding season extends from January to March, whereas my observations on the island show that they breed from August to December. It would therefore be more correct to say, as Baker and Inglis do in the case of the Purple Sunbird, 'breeds practically all the year round in some portion or other of its habitat.'

5-8-1929. Nest with two fresh eggs on a babool tree.
19-11-1929. Nest with one fresh egg on a babool tree, about three feet off the ground.
2-12-1929. Nest being constructed on the end of a palmyrah palm leaf, about twelve feet off the ground.

'The Scientific Survey of the Eastern Ghats' mentions February, March, August and December as months during which breeding has been recorded in the Madras Presidency.

***The Southern Golden-backed Woodpecker** *Brachypternus benghalensis puncticollis* (Malherbe).

A fairly uncommon bird which has not been observed by me in March and November. It is possible that the bird found on the island is *intermedius,* the Ceylon race, but this can only be established by securing a series of skins. It may also be found that both birds occur on Rameswaram Island.

The Indian Plaintive Cuckoo *Cacomantis merulinus passerinus* (Vahl.).

A very uncommon bird seen during the period September to December in the northern and north-eastern portions of the island.

A very shy retiring bird which was occasionally seen when flying from one tree to another. One bird only was usually seen, but from my notes it is observed that on 19-11-1929 four birds were seen on the same day.

Reported as a migrant appearing during the north-east monsoon in Ceylon.

***The Pied Crested Cuckoo** *Clamator jacobinus jacobinus* (Boddaert).

A fairly common bird which was observed during all the months of the year excepting May. More birds appear to have been seen from August to February than in the other months of the year. Usually found in the northern half of the island in the scrub jungle.

A pair of these birds were seen mating on 29-3-1930.

The Koel *Eudynamys scolopaceus scolopaceus* (Linnaeus).

A fairly uncommon bird only observed during October, November and December. This period corresponds with the north-east monsoon and the birds were seen eating a red fruit on a creeper that was found growing on some of the bushes and babool trees at this season.

My notes show that on 24-10-1930 a Koel was seen flying from the mainland to the island across the Pamban Pass.

In the note on the Common House Crow a record is furnished, dated 11-6-1929, in which a fresh egg was found along with three hard-set eggs. This small egg exactly resembled a Koel's in size and colouring and would point to the presence of this bird on the island during June.

It is reported to be a resident bird in Ceylon.

*The Small Green-billed Malkoha *Rhopodytes viridirostris* (Jerdon).

A fairly common bird which is seen skulking in the bushes and undergrowth in the northern half of the island. A couple of these birds can be seen any day in the year, although their numbers appear to increase during the period August to October, when from five to eight birds have been seen in a single day.

Reported as resident in Ceylon and breeding from January to November.

The Southern Crow Pheasant *Centropus sinensis parroti* (Stresemann).

While not being observed during five months of the year (i.e.) February, April, May, September and November I consider this bird is one of the more uncommon resident species on the island. Its skulking habits and the thick undergrowth in the northern half of the island must have accounted for its not having been recorded during the months previously referred to in the note.

Usually only a single bird is seen in a day, but there is a record in my notes of three having been seen on 17-12-1929.

The Green Parakeet *Psittacula krameri manillensis* (Bechstein).

A common bird which is seen practically all over the island.

These parakeets appear to breed during the months of January, February, March and June on the island as will be observed from the particulars furnished.

11-6-1929. Two birds seen entering a hole in a coconut palm, about ten feet off the ground, near Rameswaram town.

Another bird observed entering a hole in a coconut palm which was being gradually covered by a large sand-dune. The height of the hole above the sand-dune was only about five feet.

21-6-1929. Nest in a coconut palm near Rameswaram town containing two very young birds and one chipped egg, with the chick about to hatch.

31-1-1930. Two or three pairs of birds seen entering or leaving nest holes in coconut or palmyrah palms.

29-3-1930. Many birds seen entering and sitting at holes in palm trees.

19-2-1931. Several birds seen at nest holes in palm trees.

The above notes have been given in detail as it is noticed in the records of 'The Vernay Scientific Survey' that mention is made of the lack of precise details of the breeding of these birds in the Madras Presidency.

Baker and Inglis refer to February or March as the breeding season.

The Blossom-headed Parakeet *Psittacula cyanocephala cyanocephala* (Linnaeus).

A very uncommon bird only seen during May, July, August and September and then only in small numbers. The greatest number seen was five on 16-7-1930.

Usually seen sitting on the topmost branches of tall casuarina trees near Rameswaram town.

Reported as a resident bird on the island of Ceylon.

The Southern Indian Roller *Coracias benghalensis indica* (Linnaeus).

A common bird seen almost all over the island.

A nest with four young birds found in a hole in a palmyrah palm, about eight feet off the ground, on 21-6-1930. This date appears to agree with the period April to June given by Baker and Inglis in *The Birds of Southern India.*

The Little Bee-eater *Merops orientalis orientalis* (Latham).

A common bird which is seen all over the island. During July and August most of the birds appear to be without the two middle tail feathers, or these feathers have not developed so as to be longer than the rest of the tail and with the narrow terminal portions visible. By September practically all the birds had these feathers fully developed.

The Blue-tailed Bee-eater *Merops superciliosus javanicus* (Horsfield).

A fairly common bird which is seen during the period September to March. When the birds commence arriving in September nearly all of them appear with the two middle tail feathers undeveloped. By December the majority still have these feathers undeveloped, although they can be seen growing out. Towards the end of January all birds have fully developed tails. It will be seen that these bee-eaters are about from four to five months behind the previous species in attaining the full adult plumage.

The Common Ceylon Kingfisher *Alcedo atthis taprobana* (Kleinschmidlt).

A fairly uncommon bird only seen during the period May to September on the island. Usually found near ponds in the northern half of the island and along the backwaters.

The White-breasted Kingfisher *Halcyon smyrnensis fusca* (Boddaert).

A fairly common bird which breeds on the island, selecting sand banks near some of the small streams. Details in my notes show that a pair were seen working on their nest hole on 21-1-1930 and two pairs were doing the same in another bank on 31-1-1930.

Baker and Inglis record the breeding period for Southern India to be from March to July. This period may be extended to from January to July.

***The Ceylon Hoopoe** *Upupa epops ceylonensis* (Reichenbach).

A fairly common bird seen all over the northern and central portions of the island.

Baker and Inglis give the breeding season as January to May, with the remark that the early months are on the plains and the later ones on the hills. It would appear more correct to extend this period to include the month of June and to omit the remarks about the later months being on the hills.

Breeding particulars :—

9-1-1931. A bird seen entering its nest in a hole in a stone wall.
21-1-1930. Bird seen carrying food in its beak and flying towards a building.
29-3-1930. Bird seen carrying food in its beak and flying towards a building.
21-6-1930. Bird seen carrying food in its beak and flying towards a building.

The Alpine Swift *Micropus melba bakeri* (Hartert).

This bird is found on the island during the periods December to March and again from August to October. Usually found in the central and southern portions of the island. The numbers increase from December to March when parties of from twenty to forty may often be seen seated on the telegraph wires alongside the railway line. The account of these birds in the 'Vernay Scientific Survey' is interesting as both Legge and more recently Phillips suggest that the birds that visit Southern India may be daily visitors from Ceylon, where it is resident in the higher hills.

The Palm Swift *Cypsiurus parvus batassiensis* (Griffith).

A common bird seen everywhere on the island where there are palmyrah palms. Most birds are seen during the period June to September.

The Common Indian Nightjar *Caprimulgus asiaticus asiaticus* (Latham).

A rare bird only seen on one occasion on 5-6-1929 in the scrub jungle in the northern end of the island and quite close to Pamban.

Reported as a resident bird in Ceylon.

*The Southern Spotted Owlet *Athene brama brama* (Temminck).

A fairly common bird which is usually found near Pamban.

Hume procured a pair of skins of this bird which had been collected for him on 17-3-1875 near the town of Pamban.

A bird was seen seated in a hole in a palm tree on 30-1-1930, but it is not certain if it was breeding or merely using the hole as a shelter.

Although not seen by me in July, August and November it must be presumed that this was only due to the birds skulking habits and the fact that observations were not made on the island in the late evenings and nights due to the risk of fever.

The Osprey *Pandion haliaëtus haliaëtus* (Linn.).

Usually seen in the Pamban Pass during the period December to May. Birds were sometimes also seen in the extreme south of the island, flying along the coast line.

The birds seen were usually perched on navigation posts or discs in the Pamban Pass, from which they made their attacks on large fish as they went past.

The Jugger Falcon *Falco jugger* (Gray).

A very uncommon bird which was usually seen on the island during the period June to November. A single bird was also seen on 27-2-1930, this being an unusual month.

These birds were seen in the wooded portions of the island, as also along the sea coast and it is presumed that they visit the island at seasons when they are able to procure the smaller migrant waders.

*The Indian Kestrel *Falco tinnunculus objurgatus* (Stuart Baker).

A moderately common bird which is seen on the island during the period October to March. It usually frequents the northern and central portions of the island, where it can be seen hovering over the more open grassy spaces on the look out for small birds, animals and reptiles.

On one occasion a single bird was seen at the extreme southern end of the island.

A skin of this bird was procured for Hume from Rameswaram island in March 1875.

The Greater Spotted Eagle *Aquila clanga* (Pallas).

A very uncommon bird seen on three occasions on the island, in the northern half, during the months of February, July and August.

The White-bellied Sea Eagle *Haliaëtus leucogaster* (Gmelin).

A fairly common bird which was seen in every month of the year but April round the coast of the island and occasionally inland. Only one or two birds at the most were seen on any single day, but they appeared to be more numerous during the period September to November. I have been unable to find any evidence of the bird nesting on the island. Nests have however been found at Cuddalore on the east coast of the Presidency and in two instances on 28-11-1933 and again on 22-11-1934 a single fresh egg was obtained.

A detailed note on this bird has been submitted to the Bombay Natural History Society as it was noticed that the information published in the reports of the 'Vernay Scientific Survey' did not furnish full details of the distribution and breeding season. This note will appear in the journal and should be read in conjunction with these particulars.

The Brahminy Kite *Haliastur indus indus* (Boddaert).

A very common bird seen all over the island throughout the year. The number of birds seen during the two periods May to June and August to September is very much greater than at other times and is due to the fishing and fish curing operations then in progress. Most of the birds that appear at these times are non-resident birds which come over to the island from the mainland. The breeding season is mainly in January, the nests being built on coconut palms. Young birds, without the adult plumage, are commonly seen during July and August.

The Common Pariah Kite *Milvus migrans govinda* (Sykes).

A very common bird seen all over the island. The numbers increase during the same periods as recorded for the Brahminy Kite and for the same reason.

The breeding season on the island appears to be in March and again in September as my notes record a pair building on 18-2-1931 and two pairs building on 17 and 18-9-1929. In all three instances coconut palms were selected.

The Pale Harrier *Circus macrourus* (Gmelin).

An uncommon bird only seen during the period December to March. Usually seen flying over the marshy areas in the central and southern portions of the island. Two birds was the maximum number seen on any day.

The Marsh Harrier *Circus aeruginosus aeruginosus* (Linnaeus).

A fairly common bird which is seen on the island during the period October to June. As in the case of the Pale Harrier these birds are found flying over the grassy areas and marshy portions in the centre and south.

More birds are seen during November, December and January than at other times. Nine birds have been recorded in one day.

The Ceylon Shikra *Astur badius badius* (Temminck and Lang.).

A moderately common bird which has been recorded on the island during February, the period June to October and in the month of December. The largest number seen on any single day was two, in June 1929.

These birds are seldom seen on the island as they keep to the thicker babool and scrub jungle tracts in the northern part of the island.

The Indian Blue Rock-Pigeon *Columba livia intermedia* (Strickland).

A rare bird seen on two occasions on the island. A flight of about twenty being recorded on 25-10-1929 and a single bird on 9-1-1931.

The old temple at Rameswaram town is almost certain to have some resident birds which can hardly be considered to be wild, other than that they are ownerless.

The Ceylon Spotted Dove *Streptopelia chinensis ceylonensis* (Reichenbach).

A fairly common bird seen all over the northern or wooded area of the island. As some doubt existed as to whether the birds were *suratensis* or *ceylonensis* two birds were shot and measured. The result showed that it was the Ceylon Spotted Dove which was found on the island.

Length 10.5 inches. Wing 5 inches. Beak 0.63 inches.

The Indian Little Brown Dove *Streptopelia senegalensis cambayensis* (Gmelin).

A fairly uncommon bird which is found in small numbers in the northern half of the island during the period June to January. Most birds however are seen during the month of October.

***The Southern Grey Partridge** *Francolinus pondicerianus pondicerianus* (Gmelin).

A fairly uncommon bird which has however not been recorded by me during the periods March to May and again in the months of September and October.

The Port Officer at Pamban shot three partridges on 5-6-1929 and one of them was only half grown, showing that these birds breed on the island.

The Banded Crake *Rallus eurizonoides amuroptera* (Jerdon).

A rare bird on the island as only one was seen on 31-1-1930 near a dense screwpine thicket adjoining a large pool of water.

Reported as a rare but constant migrant to Ceylon during the period October to February.

The White-breasted Waterhen *Amaurornis phoenicurus phoenicurus* (Pennant).

A fairly uncommon bird seen during the month of June on two occasions. and again during the period December to February. Usually found in the northern and central portions of the island near pools which have dense cover adjoining.

Reported as a resident bird in Ceylon.

The Indian Moorhen or **Waterhen** *Gallinula chloropus indicus* (Blyth).

An uncommon bird seen in small numbers during the months of June, December and January. Usually found in the same areas as the previous bird.

The Indian Stone Curlew *Burhinus oedicnemus indicus* (Salvadori).

An uncommon bird which is only found on the island during the period June to October and then only in very small numbers in the area where babool trees and scrub jungle is found. Six birds were seen together in a patch of scrub jungle on 17-6-1929. One was shot on 23-7-1929 for identification.

It is believed to be a resident bird in Ceylon.

The Great Stone Plover *Esacus recurvirostris* (Cuvier).

A fairly common bird on the island although it was not observed by me during the months of February, May and November. More birds were however seen during June and the period October to December.

Usually seen along the sea-shore at the southern end of the island, but not always confined to this area, as birds have been seen in the sandy scrub covered tracts in the centre of the island adjoining the railway line. Usually only two birds are seen together.

Two birds were shot at different periods for identification and on examining the stomach contents it was found to consist almost entirely of small sea crabs which had been broken up and swallowed. Even the large clippers of the crabs had been swallowed by these birds.

I have a note of a nest with two eggs having been found on the island in June 1928, but cannot say that the information is correct as I did not examine the eggs.

The Great Black-headed Gull *Larus ichthyaëtus* (Pallas).

A very uncommon bird seen during October and December on the island. One bird was shot for identification on 1-10-1930. A party of twenty was seen near the coast on 5-12-1929.

It is reported as an occasional storm-driven visitor to Ceylon during the north-east monsoon.

The Brown-headed Gull *Larus brunnicephalus* (Jerdon).

A very common bird seen on the island along the coast, at the southern end, during the period September to March. Only a few birds are seen during September and October, but in November the numbers increase until in December, January and February thousands are seen on the shallow lagoons on both sides of the line near Dhanushkodi.

A few birds were shot for identification on 18-12-1929 and were found to be feeding on small prawns which collect in considerable numbers in the shallow lagoons at this season.

When the birds arrive in August many still have the brownish black heads of the breeding season and again by the end of March many birds are seen to be assuming the breeding plumage.

The Yellow-legged Herring Gull *Larus argentatus cachinnans.*

A fairly common bird which is found on the island duirng the period September to March. The numbers gradually increase until a few hundreds are seen during the period October to December. The numbers are greatly reduced in February and March, but my notes show a return of these birds on 10-3-1931, which is a late date to see more than a few stray birds. Found in the same locality as the preceding species.

The Gull-billed Tern *Gelochelidon nilotica nilotica* (Gmelin).

A fairly common bird which is found during the period July to March. The numbers gradually increase, most birds being seen during the period October to February in the same area of the island as all the gulls. It is reported that some of these terns remain all the year in Ceylon.

The Indian Lesser Crested Tern *Thalasseus bengalensis bengalensis* (Lesson).

A common bird which has been seen on the island in all the months of the year except November. The greatest number of these birds is seen during the months of June and July and it is presumed that they are then breeding on the drier sandy portions at the southern end of the island.

Eggs have never actually been taken by me at the time the eggs of the Little Tern were found, but the shell of a typical Tern's egg, which was larger than the Little Tern's, was picked up in the same area. This egg had been opened at one end by a crow or rat and emptied.

The White-cheeked Tern *Sterna repressa* (Hartert).

A very rare bird on the island, only seen on two occasions in October 1929.

The Little Tern *Sterna albifrons* (Sub-sp. ?).

A common bird which has however not been recorded during the months of September and November. Found in large numbers all along the coast line of the island and in the breeding season on the drier sandy plains at the southern end. The numbers increase conisderably during the months of June and July, when practically all the birds are breeding.

Particulars of nests found are as follows:—

10-6-1929.	1 egg, fresh, no nest but merely a depression in the sand.
19-6-1929.	1 egg, slightly set, no nest but only a depression.
21-6-1929.	1 egg, fresh, no depression in the sand and egg almost covered by drifting sand.
29-6-1929.	1 egg, hard-set, the depression containing the egg was amongst a collection of bleached bones of a cow.
9-5-1930.	Birds appeared to be considering laying and could be seen leaving the sand singly or in pairs. No birds had laid at this time.
13-6-1930.	2 eggs, fresh, no nest but only depression in the sand.
13-6-1930.	2 eggs, slightly set, no nest, only the usual depression in the sand.

It is interesting to note in 1929 that in the case of four nests found only a single egg had been laid, whereas in 1930 both nests found had two eggs each.

Many more nests could have been found in the same area without any difficulty.

***The Turnstone** *Arenaria interpres interpres* (Linnaeus).

Although this bird is a migrant some non-breeding birds are seen during every month of the year. The period during which these birds are most numerous is August to March. The birds seen and shot in July and August were in their summer plumage, while all those shot in December were in their winter plumage. By May most of the birds were assuming their summer plumage.

Hume records this bird from the island in March 1875.

Always seen in the southern half of the island along the sea-shore in company with other waders. A few birds are however occasionally seen on rocks in the Pamban Pass.

***The Eastern Grey Plover** *Squatarola squatarola squatarola* (Linnaeus).

Although a migrant some non-breeding birds are seen during every month of the year. The period during which these birds are most numerous is October to January. Many of the birds have changed into their darker, or breeding, plumage by the beginning of May and in September the change back to their winter, or lighter, plumage is observed. By the first week of October only one bird was seen in its darker plumage.

The Kentish Plover *Leucopolius alexandrinus alexandrinus* (Linnaeus).

A very rare bird that was seen on only two occasions, along with Sand Plovers, during September 1930. As the birds were not shot for identification it is not possible to say if they were of the sub-species *leggei*.

Jerdon's Little Ring Plover *Charadrius dubius jerdoni* (Legge).

A fairly common bird which was not observed in July and November. As however observations of their breeding on the island were recorded in June it must be assumed that the birds were on the island with their young in July.

These birds are reported to breed in Ceylon in June. Although they breed on Rameswaram Island in June most birds are seen in the period December to February. The numbers appear to increase somewhat in May.

Two nests were found on 10-6-1929. One nest had one and the other two eggs; the eggs in both nests being fresh.

The Lesser Sand Plover *Charadrius mongolus atrifrons* (Wagler).

A fairly common bird seen usually near the coast at the southern end of the island. Most birds are seen during the periods September to March and again in June and July. Some non-breeding birds are resident on the island the whole year.

The Greater Sand Plover *Charadrius leschenaulti* (Lesson).

This bird is seen in small numbers throughout the year. Usually found along with the preceding species, but are really uncommon on the island. No more than six birds were ever seen on a single day.

The Eastern Golden Plover *Pluvialis dominica fulva* (Gmelin).

A fairly common bird which visits the island from September to March each year. Usually found at the southern end of the island, but not entirely confined to this area, as they are seen in small flocks on the grassy moist areas in the centre and western side.

I have noticed birds with the darker summer plumage on their arrival in September, but the change to the breeding plumage has not been noticed before they leave the island.

These birds evidently stay longer in Ceylon as they are reported to arrive in August, when some bear traces of the summer plumage, and leave again in April, having a large amount of black on the breast.

The Yellow-wattled Lapwing *Lobipluvia malabarica* (Boddaert).

A fairly uncommon bird which was seen during the months of January and February, July and August and October and November. Usually seen on the eastern side of the island, between Pamban and Rameswaram town, on large flat sandy plains covered with a light growth of grass and some scattered thorn bushes. The largest number seen on a single day was fourteen, but it was usual to see only from two to four birds.

The Black-winged Stilt *Himantopus himantopus* (Linnaeus).

A fairly uncommon bird which is seen in the south of the island, near the coast, during the period January to March. A few stray birds have however been recorded in July and November and may be resident birds from Ceylon which had come over to Rameswaram Island.

These birds are reported as resident in Ceylon and breed from April to June in large colonies round certain lagoons along the east coast. Some birds are also reported to breed in India.

Most birds are seen on Rameswaram Island during February and I have a record of seeing over a hundred on 27-2-1930.

Very little has been said about this bird being found in the Presidency in the report of the Vernay Scientific Survey.

The Avocet *Recurvirostra avocetta* (Linnaeus).

A rare bird which was recorded on one occasion on 2-9-1930. When about eighty were seen in a shallow sheet of water along the railway line at the southern end of the island, near Dhanushkodi. The birds were observed for some time and no mistake was made in their identification.

It is stated in the report of the Vernay Scientific Survey that further evidence, to that recorded in it, is required before this bird can be admitted to the Presidency list.

This information, together with the record of September 1930, should be sufficient to admit this bird, as an uncommon migrant, to the list of birds of the Madras Presidency.

Wait, in *The Manual of Birds of Ceylon*, refers to the Avocet as a rare straggler, in winter, which has been obtained near Jaffna.

The Easten Curlew *Numenius arquata* (Linnaeus).

A fairly common bird which is found throughout the year on the island. The numbers seen during the period of the north-east monsoon do not appear to exceed by very much those seen at other times of the year. Perhaps the smallest numbers seen are in the period April to July, although I have records of having seen twenty-five and twelve on two days in June 1929. There must however be a large number of non-breeding birds which remain on the island each year to account for the birds seen in the dry season. Curlews are confined to the southern area of the island and are usually found along the coast line.

*The Whimbrel *Numenius phaeopus phaeopus* (Linnaeus).

A fairly common bird which is seen during the period September to February in the same areas of the island as the Curlew. As I have records of stray birds in June and July it points to the fact that certain non-breeding birds remain on the island all the year, or else that some birds arrive at least three months in advance of the usual migrants.

The Green Sandpiper *Tringa ochropus* (Linnaeus).

A moderately uncommon bird seen during the period October to March by the side of shallow borrow pits along the railway line in the northern and central areas of the island. The maximum number seen on any single day was six, two or three being the usual.

☐ The Marsh Sandpiper *Tringa stagnatilis* (Bechstein).

A fairly common bird seen during the period September to March in the same areas as the preceding species and also in the southern half, where it is commonly found in small flocks along with other waders. Very few birds are seen in September and October, but the numbers gradually increase until in January thirty to forty birds may be seen in a day.

The Common Sandpiper *Tringa hypoleucos* (Linnaeus).

A fairly uncommon bird seen during the period September to March and usually confined to the northern coast line of the island. Only a few birds were seen on any single day, the majority were seated on the sandstone rocks alongside the railway bridge over the Pamban Pass.

Tha Wood Sandpiper *Tringa glareola* (Linnaeus).

A fairly common bird seen during the period October to March almost throughout the island where there are pools of water. The greatest number was observed during January and February.

The Redshank *Tringa totanus* (Linnaeus).

A fairly uncommon bird seen during the period September to February along the south coast of the island on the margins of the shallow lagoons on both sides of the railway line. Most birds were seen during the months December and January.

Birds were shot in September and December for identification.

The Spotted or **Dusky Redshank** *Tringa erythropus* (Vroeg).

A very rare bird only once seen on the western side of the island, in a backwater, on 18-9-1929. Eight birds were seen on this occasion.

This bird has been reported from the Jaffna Peninsula in Ceylon.

The Greenshank *Tringa nebularia* (Gunnerus).

A moderately common bird seen during the period September to March in the southern half of the island along the coast and on the margins of the shallow lagoons in the same area. I find one record in my notes of having seen three of these birds on 12-7-1929, which seems an unusually early date. Most birds are seen during the period December to February.

Wait, in the *Manual of the Birds of Ceylon*, mentions that a good many immature birds remain in Ceylon during the south-west monsoon.

The Sanderling *Crocethia alba* (Vroeg).

Although this bird has been reported to be rare in Ceylon, only one specimen being obtained, it can be said to be common on Rameswaram Island as I have records of it for every month of the year.

Baker and Inglis refer to the bird as a rare winter visitor and quote Jerdon as having obtained it on the sea coast at Nellore. The account of the Vernay Scientific Survey gives the same reference, but states that Jerdon reports it as tolerably abundant on the Nellore coast.

My notes show that the season when these birds are found in large numbers is August to February, when on occasions more than a thousand have been seen in flocks along the sea coast and flooded sand flats at the southern end of the island. Usually seen along with Little Stints and Curlew Stints, but also found in large flocks consisting of Sanderlings alone.

A bird was shot as early as 10-6-1929, which shows that certain non-breeding birds remain on the island the whole year.

The Little Stint *Erolia minuta minuta* (Leisler).

A very common bird which is seen in large numbers during the period September to March. Confined to the southern end of the island and found in the same areas as the preceding species.

Non-breeding birds remain on the island during the other months of the year and have been shot for identification during these months.

Reported to be a common bird all round the coast of Ceylon, a few immature birds staying on the island during the summer.

The Eastern Little Stint *Erolia minuta ruficollis.*

This bird is found on the island along with the preceding species, as a bird shot along with a big flock on 30-9-1930 proved on identification to be the Eastern Little Stint with black legs.

I am unable to say if this species is more uncommon than the preceding as a sufficient number were not shot to arrive at any correct estimation.

The Curlew Stint *Erolia testacea* (Pallas).

A very common bird which is seen on the island throughout the year. The period during which the greatest numbers are recorded is August to March, but numerous birds are seen at other times.

Two birds were shot on 10-6-1929 which still retained their winter plumage, although all birds shot early in August were in their summer or breeding plumage. Twelve birds were shot on 18-12-1929, all being in their winter plumage.

Wait reports that these birds are abundant all round the coast of Ceylon and that immature birds in considerable numbers stay on the island during the summer.

The Pin-tailed Snipe *Capella stenura* (Bonaparte).

An uncommon bird seen in small numbers in the month of January, in the northern area of the island where there are marshes with undergrowth, such as screw-pine and other shrubs.

It is presumed that some of the snipe that usually visit Ceylon during the north-east monsoon occasionally rest on Rameswaram Island for a short period.

A Snipe was shot by me on 20-1-1930 and identified as belonging to this species.

The Open-bill Stork *Anastomus oscitans* (Boddaert).

A fairly uncommon bird which was recorded from the northern half of the island, where there are some swamps and tanks, during the period October to January. One stray bird was recorded on 10-7-1929 in the southern half of the island and may have been blown over from Ceylon, where they are reported as resident, by the south-west monsoon winds.

The Eastern Gray Heron *Ardea cinerea rectirostris* (Gould).

A very rare bird which was recorded on only one occasion, on 31-1-1930, when a single bird was seen seated near a pond in the north of the island near Pamban.

The Indian Smaller Egret *Egretta intermedia intermedia* (Wagler).

A very rare bird which was recorded on only one occasion, on 31-1-1930, when seven birds were seen together, on a sand flat, on the western side of the island.

The Indian Reef Heron *Demiegretta asha* (Sykes).

A rare bird seen on two occasions on the western coast of the island where they were feeding in shallow sea water just off the coast. Six birds were seen together on 6-12-1929 and eighteen in one batch in the same area on 31-1-1930.

It is recorded that this heron has been found breeding, near Chilaw on the Island of Ceylon, about the end of May. The birds seen on Rameswaram Island may possibly be from Ceylon. These herons are reported as being rare in Ceylon.

The Common Pond Heron *Ardeola grayii* (Sykes).

A fairly common bird on the island, found during the periods October to March and May and June, in the northern half of the island where there are pools of water or marshy areas. Fairly large numbers are seen during the north-east monsoon period, whereas only one or two birds were recorded in May or June.

The Black Bittern *Dupetor flavicollis flavicollis* (Latham).

An uncommon bird seen usually on the western side of the island, along the backwaters, where there are dense screw-pine and mangrove thickets. Usually only seen singly, seated on the twisted mangrove roots or flying across the narrow backwaters.

The months during which I have records are June, July, September and December, so that it is possible that this bird is resident and breeds on the island as it is suited to its requirements both as regards food and cover.

The Flamingo *Phoenicopterus ruber roseus* (Pallas).

A fairly common bird seen on the island during the period November to March each year. Only found at the extreme southern end where shallow lagoons are formed on both sides of the railway line. Most of the birds frequent the lagoons along the eastern shore, but some parties cross over to the western side later in the season.

They usually arrive at the end of November, when a few hundred birds are suddenly seen one morning. The numbers rapidly increase until it is estimated that about three thousand birds gather in this area.

The winter of 1929-30 apparently suited the birds better than that of 1930-31, as they were very numerous and never left the island for short periods once they arrived. They finally left on 12-3-1930.

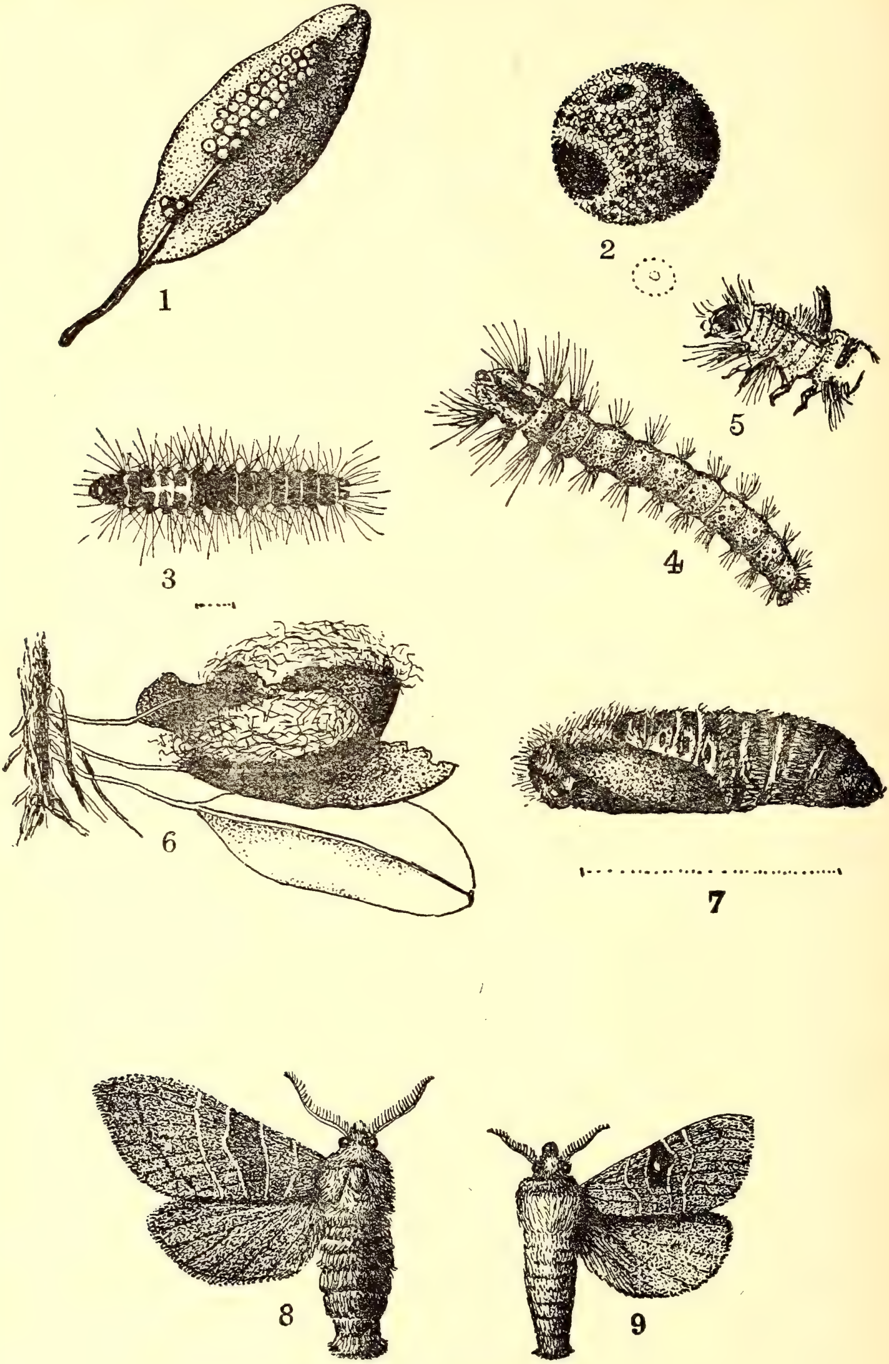
In the winter of 1930-31 the birds arrived on 13-11-1930, but left after a week and only returned again during the first week of December. On 8-1-1931 three or four hundred birds were seen to have collected and this number was not exceeded that season. All the birds again left about 31-1-1931, when the lagoons almost dried, but returned once again in much smaller numbers about 16-2-1931. Only about fifty birds remained on 10-3-1931 and these left shortly after.

When these flamingoes leave the island they usually fly north and spend some days near Mandapam Camp and are finally seen in fairly large numbers on a tank at Ramnad.

Wait reports that flamingoes are migrants to Ceylon, arriving in October and leaving in April. He states that some birds must loiter as they have been seen near Trincomalee in June. He also refers to a tradition that they are supposed to breed in the extreme south of the Eastern Province, but states that this has not been verified.

The Little Grebe *Podiceps ruficollis capensis* (Salvadori).

An uncommon bird which is only seen during January and February on the island at the northern end and in the centre. Usually found in the borrow pits adjoining the railway line and in smaller ponds and swampy areas to the north-east. More birds are seen in January than in February, but not more than five birds were seen on any single day.



Metanastria hyrtaca Cram.
(*For explanation see end of article*).

A NOTE ON *METANASTRIA HYRTACA* CRAM.

BY

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(*With a Plate*)

INTRODUCTION.

Of the members of the family *Lasiocampidæ* very few are serious pests of cultivated crops in South India. *Taragama siva* and *Trabala vishnu* are the only two, appearing occasionally in large numbers and doing appreciable damage to economic plants; and even these are rather rare. *Metanastria hyrtaca* probably comes third in the list. In the year 1934 this insect appeared in large numbers and the caterpillars almost completely defoliated a few Sapota plants in the orchard of the Central Farm of the Agricultural Research Institute at Coimbatore. The following is a short account of the observations made by the authors at that time.

THE MOTH.

The adult moth is fairly big with grey brown wings and rather thick-set body. The male is smaller than the female, has pectinate antennæ and has a black patch on the forewing with a white spot in the centre of it. The abdomen is long and slender and extends behind beyond the wings and has a brush of long hairs at its end. In the female the wings are longer and broader and have short wavy lines or bands across them; the black patch on the forewing is absent. The antennæ are thinner and smaller. The moths are sluggish and do not fly.

Hampson in *Fauna of British India,* 'Moths', Vol. I. gives the following description of the moth on page 410:

'Male: Pale or dark red brown; palpi dark below. Forewing with two ante-medial pale lines and two post-medial angulated lines, with an almost black patch between the upper part of the ante- and post-medial lines crossed by the pale veins and with a white lunule on it; a lunulate sub-marginal line. Underside of the hind wing with two pale lines.

'Female: Forewing with the two ante-medial and the two post-medial lines more distinct and without the dark patch and white lunule; the sub-marginal lunulate line very indistinct. Hind wings with an indistinct pale line.'

Moore's *Lepidoptera of Ceylon*, Vol. II, page 148 has the following description of the moth:

'Dark purplish ferruginous. Male: Forewing with a transverse ante-medial and a post-medial slightly waved ferruginous-grey line, and two similar medial lines, the outer one being convexly angular beyond the cell; between the two lateral lines is a dark purple brown patch extending from the costa to the lower median vein, this patch being marked by a pure white lobate spot; exterior border darker, crossed by a very indistinct submarginal row of dark brown speckled spots. Female: Forewing with four similar transverse ferruginous grey equidistant lines; the basal area between the medial lines, and the outer border darker coloured, the submarginal row of spots more distinct and grey speckled. Front of thorax, head, palpi and antennæ greyish ferruginous. Expanse: Male 1⅞ in. Female 3 in.'

LIFE HISTORY.

The moths copulate the very next day after emerging from the pupæ and the female lays eggs in groups or rows on the surface of the leaves or twigs of the food plant. Each female is capable of laying about 140 eggs, which it does in several batches in the course of two or three days. The eggs hatch in nine to twelve days. The caterpillars are active from the second day and lead a gregarious life. They move about on the leaves and stem in single file. They feed on the tender leaves by scraping the surface for three to five days and then undergo the first moult. There are generally six or seven moults during the caterpillar stage, though, in exceptional cases, the number may go up to ten or be reduced to four; but there is no marked change in them after the fifth moult. Just before moulting the caterpillars remain motionless on the stem or the leaf, having ceased feeding a day or two earlier. In the actual process of moulting the head shield is first pushed forward by the formation of fresh growth below and gradually gets detached; this is followed by the rupture of the outer skin all along the body and the caterpillar emerging out of the larval skin, which is often left almost entire. The new larva is smaller in size but regains the normal size in a short time. The caterpillars feed voraciously, and become full grown in 45 to 60 days. The larval period may be reduced to 43 and increased to over 100 days in rare cases. A few prolong their larval period by cessation of growth for a long time after the fourth moult, so that in the same brood some caterpillars grow in advance of others, a good number lagging behind. The full grown caterpillars construct loose cocoons of silk inter-woven with hairs from their bodies and pupate inside. The cocoons are generally attached to the stem or leaf; and often two or more cocoons are found grouped together. The pupal period varies from 9 to 18 days. Thus, the whole life cycle from egg to adult takes 75 to 109 days depending on weather and other conditions.

Egg: The egg is spherical in shape and about 1½ mm. in diameter, i.e., about the size of a mustard seed. It is dull white in colour with two big brownish black round markings and a smaller one between. It is covered with dirty grey irregular faint markings making the colour appear ashy grey at a distance. The shell is hard and finely sculptured on the surface.

Larva (*1st stage*): The newly hatched larva is about 2½ mm. long with the head 7/10 mm. broad. The segments of the head and the thorax are slightly bigger than the remaining segments so that the body appears to taper slightly towards the hind end. The head is black and covered with minute hairs. Segment I is blackish with a dorsal prothoracic chitinous shield bounded by a thin greyish white area. This is separated from segment II by a double ring, greyish pale white in colour with a black transverse streak in the middle. The three thoracic segments have a fairly broad dorso-median longitudinal blackish grey band with a central whitish area or streak which broadens towards the third segment. Each segment has on the ventral side a pair of well developed black legs covered with minute velvety hairs. The abdomen is black with the dorsal side of the first three segments slightly greyish as a continuation of the thoracic longitudinal streak. The greyish colour is interrupted by the inter-segmental rings which are dirty pale white. On the ventral side are the four pairs of brownish black slender prolegs on the third to the sixth abdominal segments and a fifth pair on the last or anal segment. The whole body of the caterpillar is covered with numerous hairs arising singly or in tufts from black tubercles. On the prothorax are a large number of long hairs directed forwards and sideways. The spiracles are seen as small dots on the sides of the body on segment I and the first eight segments of the abdomen, the first pair being slightly bigger than the rest. The caterpillar leads a very active and gregarious life, feeding on the tender leaves for three to five days and attains a length of nearly 6 mm. Then it ceases feeding and undergoes the first moult.

Larva (*2nd stage*): The caterpillar is now about 8 mm. long. The thoracic segments are only slightly broader than the rest of the body and the anterior portion appears a little tapering as the head is narrower than the thoracic segments. The head is blackish with three slight ashy grey bands extending from the prothoracic region down to the clypeus. There are a large number of short hairs arising from the head near the jaws. The dorsal side of the prothorax is black with a pair of light grey longitudinal bands on either side of the median line. The black chitinised area is bounded by greyish brown patches in front and behind; and there are more irregular patches on the sides. The prothoracic processes are short, thick and black with numerous short soft whitish hairs extending forward. Some of these hairs are black or brownish. In the prothorax are also numerous isolated smaller and thinner brown hairs along the middle frontal fringe, the sides and the posterior edges. The mesothorax is black with greyish brown mottlings; the dorsal tubercle on each side of the median line is bluish black covered with short irregular hairs; two small erect groups of hairs are found on the dorsal side of the segment marking the position of the transverse groove. Segment III is greyish brown with irregular black spots and patches and with bluish black tubercles. Towards the posterior end of the segment a transverse slit is visible, its inner sides are lined with very minute shining velvety hairs of a brick red colour. In the abdominal segments the mid-dorsal double line of the previous stage is broken up into irregular ash coloured mottlings and the lateral whitish bands are continued behind upto the eighth segment. The first two segments appear greyish brown and the rest are darker. The eighth, ninth and tenth segments are black with white thick intersegmental transverse patches or rings. The abdominal tubercles are bluish black and more prominent with blackish hairs arising from them. One sub-dorsal and one ventro-lateral row of tubercles are seen on each side of the body, the latter row being on short blunt protuberances of the skin on the sides. The whole body is covered with irregularly distributed short brown hairs. The hairs on the sub-dorsal tubercles arise erect while those on the ventro-lateral tubercles are directed sideways. They are directed forwards in the anterior segments and backwards in the posterior or anal segment. The prolegs which are more conspicuous than in the previous stage are slender, long, pale red, and are beset with numerous small hairs.

The caterpillar during this stage is more active and feeds voraciously. It grows to a size of 10 or 11 mm. in the course of 4 to 6 days and then undergoes the second moult.

Larva (*3rd stage*): The average caterpillar is about 16 mm. long. It is black grey with reddish and brown dots and pale white streaks irregularly distributed over the body. The newly moulted caterpillar has its head as broad as the thorax so that there is no tapering towards the head as in the previous stage. The head, the first and second segments of the thorax, and the eighth, ninth and tenth abdominal segments are black and separated from their neighbouring segments by whitish double transverse bands. The three whitish grey bands of the first thoracic segment are continued into the head region. The prothoracic processes are more pronounced with tufts of hairs. Over the second thoracic segment the paired tufts of small hairs on the mid-dorsal line, one behind the other, enclose between them a transverse depression which is lined black. The third thoracic segment has the red streak more pronounced and the posterior border of the segment is whitish as a distinct transverse band. Similarly between segments 4, 5 and 7 and 8 whitish transverse bands appear borne on the posterior border of the one and the anterior border of the following segment. Segment 8 is black and bears a somewhat conspicuous pair of dorsal tubercles more prominent than others. Segments 9 and 10 and the legs are black. The prolegs are yellowish with a black patch on the outer side. The spiracles are white vertically oval spots with black borders situated in a line on the sides of the body wall. The ventro-lateral processes from the body wall are more prominent with denser and longer hairs. The hairs are of varying length, shape and shade; they are at first whitish turning brown or brownish black later on. The hairs on the dorsal side of the body are generally shorter than the rest. The ventral side of the body is blackish or of cement colour, The caterpillar feeds gregariously and grows to about 20-22 mm. and, as it grows, the head appears a little narrower than the body. The white central band in the region of the head bifurcates near the front and three more parallel lines of whitish tinge on each epicranium extend down to the ocellar region the one next to the central streak being more prominent than the others. It is not uncommon to find caterpillars at this stage reaching a length of 30-40 mm.

Larva (4*th stage*): Immediately after emerging from the moult the caterpillar is 25-40 mm. long. The brown colour of the hairs on the surface of the body becomes more pronounced. Secondary hairs appear all over the body, the base of the legs, the prolegs and the head, making the tubercles rarely visible. The erect comb-like hairs over segment II and the lateral hair groups on the ventro-lateral processes on the body are more prominent than in the previous stage. Besides the soft hairs there are also whitish or yellowish brown shorter flattened spatulate hairs arising in the midst of the ventro-lateral tufts. Segment III is the biggest and the thoracic segments are progressively smaller anteriorly, with the head appearing smallest. The dorsal bands on the thorax are darker and are continued into the head region. The general colour is greyish brown with irregular mottlings, simulating the bark of the stem of the food plant. Beyond this stage the caterpillars show no marked changes except in size. They remain on the stem in groups closely packed together. Some of the larvæ moult at the end of 5 to 7 days and reach a size of nearly 40-50 mm. But the length of this stage and the size of the larvæ at the end of it vary greatly.

Larva (5*th stage*): This is generally the last stage in the growth of the larva, the caterpillar becoming full grown at its end. Beginning with a size of nearly 40 mm. it finally reaches about 65 mm. The body is stout and hairy and is cylindrical though slightly flattened on the ventral side. The head is small when compared with the other segments of the body, and black with whitish, brownish and dark bands. A dorso-median brownish band extends from the erect mid-dorsal tufts on segment II over the thorax into the head region and merges with the colour pattern of the head. The ad-frontal area is whitish and is in continuation of the central white streak on the cranial suture. The front is small and black. The ocelli are black and surrounded by brownish black patches at the sides. Numerous small brownish soft hairs are found over the head and mouth region. The skin of the body is tough and leathery beset with various kinds of hairs. The general colour varies, being greyish black or greyish dark brown. The hairs are of different colours and sizes. The longest hairs found in bunches rising from the vento-lateral body processes are soft and brownish. Some of the hairs rising from bluish black tubercles on the dorsal surface are fairly long and spike-like, are easily detached from the body and run into the fingers of the operator when the caterpillars are handled. Thinner, shorter and greyish dark hairs are seen in the region of the thoracic segments, legs, prolegs, lateral processes and posterior ends. A few yellowish white spatulate hair-like structures arise in front of the dorsal tuft in segment II and irregularly in the midst of the lateral tufts in all the segments. Several groups of very soft minute hairs are found in the dorsal transverse grooves in segments II and III and in the intersegmental areas on the dorsal side. The ventro-lateral processes from the body wall are more prominent and the tufts of hairs are directed forwards in thoracic segments, horizontally over the sub-stratum in the abdominal region and backwards in the posterior segments. The latero-ventral processes on the prothorax are very long and thickset with hairs. These processes simulate prolegs and hide the true legs when viewed from above. The dorsal setae are comparatively small and reduced. In segment II the transverse cleft of skin placed dorsally about the middle of the segment exposes a jet black area bounded in front by a short tuft of whitish yellow hairs and behind by a shorter erect tuft of black hairs. In segment III the transverse slit placed about the posterior third of the segment, is broader and longer, extending to the sides and exposes a crimson red surface with a black streak in the middle. The skin in the slit is lined by very minute hairs and is smooth. The slit is exposed to view with its vivid colouration when the caterpillar is disturbed. The legs are black, well chitinised and covered with numerous hairs. The abdomen is long and stout with tufts of hairs on the sides. The dorsal hairs and setae are reduced in number and size. There are two pairs of bluish black tubercles on each segment; the front pair are subdorsal and the hind pair posterior-lateral in position. In the mid-dorsal region two blackish brown bands begin to appear in some specimens and this band is produced into angular projections outwards in segments III to VIII. In some specimens a lateral pale grey streak continued from the first to the eighth abdominal segment appears as a faint band and persists during the later stages of the caterpillar. The prolegs are long and slender with the crotchets biordinal and arranged in meso-series. The spiracles are clearly seen as long vertical slits, more or less oval in shape, whitish in the centre and bounded by a thick black rim enclosing a thin black streak in the central line; the spiracle in segment I is the biggest and that on segment VIII bigger than the rest; they are located on the sides, just above the region of the ventro-lateral processes.

Pupa: When full grown the caterpillars construct loose cocoons of silk interwoven with hairs detached from their bodies and pupate inside. The cocoon is generally attached to the stem or leaf and often two or more are found grouped together. The pupa is dark brown and covered with numerous short hairs irregularly distributed in front, but in rows round the pupa behind. The moth emerges by splitting open the pupal skin at the dorso-median anterior end. The pupal period lasts from 9 to 18 days.

OTHER FOOD PLANTS.

The caterpillars which are characteristic in their appearance and habits and are easily distinguished from others have been recorded to breed on *Guazuma tomentosa* H.B. & K., *Terminalia catappa*

Linn. (Country almond), *Mimusops elengi* Linn., *Nyctanthes Arbor-tristis* Linn. (Tam. Pavizha mall), *Bassia longifolia* Linn. (Tam. Iluppai), *Schima Wallichii* Choisy, *Eugenia Jambolana* Lam., *Acacia arabica* Willd., *Albizzia stipulata* Boiv., and *Anthocephalus morindaefolius* Korth.

REMEDIAL MEASURES.

As already pointed out the insect has not been noted to be a serious economic pest and as such no elaborate arrangements are necessary for its control. But if and when it becomes a pest, the gregarious nature of the caterpillars makes it easy to handpick and destroy them. In more severe cases a stomach poison may be tried.

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EXPLANATION OF PLATE.

1. A leaf showing eggs on it.
2. One egg magnified.
3. A young caterpillar.
4. A full grown caterpillar.
5. The anterior portion of a grown up caterpillar showing the hairs.
6. Cocoon on a leaf.
7. Pupa.
8. Moth (female).
9. Moth (male).

THE MEDICINAL AND POISONOUS SPURGES OF INDIA.

BY

J. F. Caius, S.J., F.L.S.

The Euphorbiaceæ represent almost all habits of growth, and exhibit a high degree of adaptability to varying environments. This large family includes 220 genera, and about 4,000 species distributed all over the world, except in arctic and antarctic regions. About half the species inhabit equatorial America; they are much rarer in temperate America. In the Old World they are more abundant in the Mediterranean region and in temperate Asia than between the tropics.

The properties of the spurgeworts are as distinctive as their botanical characters, and the ancients had so accurately recognized this, that all plants with a 3-coccus fruit were regarded by them as hurtful and suspicious. The members of the family secrete a very acrid milky juice, varying in strength with the species, the organ of the plant, and the climate. In some this juice is one of the most deleterious of poisons, in others its acridity is so far neutralized by mucilage and resins as to reduce it to a simple purgative and diuretic. Some species are slightly narcotic-acrid, others aromatic. The albumen usually contains a fixed bland oil, without the acridity which is found in the embryo and the integuments of the seed. It is to a liquid resin and a volatile principle that all the properties of the spurgeworts are due; they are thus strongest in alcoholic tinctures, but are dissipated or weakened by the application of heat. The root of the Manihot offers a remarkable example : there is scarcely a more poisonous juice than this, yet the action of fire converts the plant into very wholesome food.

Enormous though it be, the research work purporting to deal with the juice has not yet been crowned with success, and the literature regarding the toxic principles isolated from spurges is but one great mass of confusion.

The medicinal and poisonous spurges of the world belong to 76 genera:—Acalypha (tropics and subtropics of both hemispheres); Alchornea (all tropics); Aleurites (Asia and Pacific); Andrachne (tropics and subtropics); Anthostema (Madagascar; tropical Africa); Antidesma (palaeotropics); Aporosa (tropical Asia); Baliospermum (Indo-Malaya); Bischofia (Indo-Malaya, Pacific Islands); Breynia (Africa, Asia, Polynesia); Bridelia (Africa, Asia, Australia); Buxus (temperate regions of the Old World); Chrozophora (Mediterranean region, Asia, Africa); Cicca (Asia); Cleistanthus (Africa, Indo-Malaya); Cnesmone (India, Malay Peninsula, Java, Sumatra); Croton (tropics and subtropics); Dalechampia (tropics); Daphniphyllum (tropical Asia); Dichostemma (tropical Africa); Drypetes (Africa, Indo-Malaya, tropical America); Elaeophorbia (tropical

Africa); Eremocarpus (California); Erythrococca (tropical Africa); Euphorbia (subtropical and warm temperate regions); Excoecaria (Old World tropics); Flueggea (Old World tropics); Gelonium (Asia, Africa); Glochidion (tropical); Hevea (Brazil, Guiana); Hippomane (warm America, West Indies); Homonoia Indo-Malaya); Hura (tropical America); Hymenocardia (Indo-Malaya, Africa); Ichthyothere (Brazil); Jatropha (America, Malaya); Johannesia (Brazil); Julocroton (Central and South America); Mabea (Central America, Brazil, Guiana); Macaranga (tropics of the Old World); Maesobotrya (tropical Africa); Mallotus (Asia, Africa); Manihot (South America to Mexico); Manniophyton (tropical Africa); Maprounea (Brazil, Guiana, West Africa); Mareya (tropical Africa); Mercurialis (Europe, Western Asia, Japan); Microdesmis (Asia, Africa); Necepsia (tropical Africa); Oldfieldia (tropical Africa); Omphalea (tropical Africa and America); Ophthalmoblapton (Brazil); Paris (Europe, northern Asia); Pedilanthus (Central and South America, West Indies); Petalostigma (Australia); Phyllanthus (tropics); Pseudolachnostylis (tropical Africa); Putranjiva (India); Pycnocoma (tropical Africa, Comoro Islands, Madagascar); Richeria (tropical America); Ricinodendron (tropical Africa); Ricinus (tropical Africa); Sapium (all tropics); Sauropus (Indo-Malaya); Sebastiania (America, Africa); Spondianthus (tropical Africa); Stillinga (America, Africa, Mauritius, Madagascar, Fiji); Synadenium (tropical and South Africa, La Reunion); Tetracarpidium (tropical Africa); Tetrorchidium (tropical America and Africa); Toxicodendrum (South Africa); Tragia (Asia, Africa); Trewia (India); Trigonostemon (Indo-Malaya); Tritaxis (Indo-Malaya); Uapaca (tropical Africa, Madagascar).

The medicinal and poisonous spurges of India belong to 36 genera:—Acalypha, Alchornea, Aleurites, Andrachne, Antidesma, Aporosa, Baliospermum, Bischofia, Breynia, Bridelia, Buxus, Chrozophora, Cicca, Cleistanthus, Croton, Euphorbia, Excoecaria, Flueggea, Gelonium, Glochidion, Hippomane, Homonoia, Hura, Jatropha, Macaranga, Mallotus, Manihot, Microdesmis, Phyllanthus, Putranjiva, Ricinus, Sapium, Sauropus, Sebastiania, Tragia, Trewia.

A. Cells of ovary 2-ovuled.
  I. Male flowers of one pedicelled stamen numerous surrounding a single-pedicelled female, all enclosed in a cup-like involucre ... ... Euphorbia.
  II. Flowers apetalous; sepals 4 in male, imbricate; sepals 4 or 6 in female.
    a. Leaves alternate ... ... Hura.
    b. Leaves opposite ... ... Buxus.
  III. Sepals 1-2-seriate. Petals minute or absent. Stamens 1-2-seriate. Ovary 2-many-celled; cells 2-ovuled.
    a. Leaves alternate, undivided, quite entire. Flowers petaliferous. Stamens 3-6.
      1. Calyx valvate, stamens in a column.
        i. Fruit a drupe; ovary 2-celled ... Bridelia.
        ii. Fruit capsular; ovary 3-celled ... Cleistanthus.
      2. Calyx imbricate, stamens free. Flowers small. Disc of 10 glands. Herb ... ... Andrachne.

b. Leaves alternate, rarely subopposite, undivided, quite entire. Sepals imbricate. Petals absent. Stamens 3 or more. Flowers solitary or in axillary fascicles.
  1. Fruit dry capsular of 3 bivalved cocci.
    i. Herbs, shrubs or trees; styles free or united below; disc present, of scales or a ring ... Phyllanthus.
    ii. Shrubs or trees; styles long united in a column, rarely free; disc absent ... Glochidion.
  2. Fruit of 6 cocci; epicarp fleshy white ... Flueggea.
  3. Fruit baccate of 3 to 6 hard cocci in a fleshy epicarp.
    i. Sepals 4; stamens 4; fruit large; tree ... Cicca.
    ii. Male flowers turbinate or hemispheric, lobes minute; fruit small; shrubs or treelets ... Breynia.
    iii. Male flowers rotate or discoid, lobes minute; fruit medium; shrublets ... ... Sauropus.

c. Leaves alternate, undivided, entire or serrate. Sepals imbricate. Petals absent. Stamens few or many. Styles or stigmas 2-3, dilated. Fruit a drupe.
Stamens 2-3. Ovary 2-3-celled. Drupe 1-celled Putranjiva.

d. Leaves alternate, trifoliolate. Sepals imbricate. Petals absent. Fruit a berry.
  Sepals 5. Stamens 5 ... ... Bischofia.

e. Leaves alternate quite entire. Styles or stigmas usually very minute. Fruit various.
  1. Fruit drupaceous; disc circular pulvinate or conic; seeds laterally flattened reticulate; filaments long ... ... Antidesma.
  2. Fruit capsular dehiscent; flowers in catkins; filaments long ... ... Aporosa.

B. Cells of ovary 1-ovuled.

I. Perianth double, of calyx and corolla. Stamens 4-10; filaments free. Ovary 1-3-celled. Fruit a small drupe.
  Flowers in axillary panicles. Petals imbricate. Stamens 5-10 ... ... Microdesmis.

II. Perianth single, or of the male, or of both sexes, double. Stamens 1-2-seriate. Ovary 2-3-celled. Inflorescence terminal or axillary.
  a. Flowers in terminal 2-3-chotomous cymes; cymes unisexual, or with the central flower female, petaliferous.
    1. Leaves digitately nerved or lobed. Stamens many. Fruit capsular ... ... Jatropha.
    2. Leaves palmilobed. Juice usually milky. Stamens 10 in two whorls ... ... Manihot.
    3. Leaves digitately nerved. Stamens 8-20. Fruit a drupe ... ... Aleurites.
  b. Flowers in terminal androgynous spikes or racemes. Petals usually villous. Stamens strongly incurved in bud alternate with the sepals. Capsule of 3 cocci. Croton.
  c. Flowers in axillary racemes. Stamens erect in bud. Petals present. Sepals valvate. Anther-cells connate. Styles bifid. Fruit capsular. Stellately tomentose herbs or shrubs ... ... Chrozophora.
  d. Flowers in axillary rarely terminal spikes racemes or panicles, apetalous. Calyx valvate in bud.
    1. Filaments free; anthers erect, 2-celled, cells united by their base only. Styles very long fimbriate or lacerate. Female flowers in large bracts ... ... Acalypha.
    2. Filaments free; anthers 2-celled or 4-locellate; cells oblong or globose, laterally attached by a narrow or broad connective.
      i. Stamens 4 to 10. Anthers 2-celled. Filaments slender, anther-cells oblong parallel. Alchornea.

ii. Stamens very numerous. Anthers 2-celled.
   † Leaves opposite. Anther-cells parallel. Fruit fleshy or capsular ... ... TREWIA.
   †† Leaves opposite or alternate. Stamens very many, central in the flower; anther-cells usually globose, adnate to the often broad connective ... ... MALLOTUS.
iii. Stamens one or more central; anthers 3-4-locellate; anther-cells subglobose. Styles entire. Fruit capsular ... ... MACARANGA.
3. Filaments variously connate in bundles.
   i. Male and female flowers in axillary spikes. Staminal bundles indefinite. Capsule unarmed ... ... HOMONOIA.
   ii. Flowers in terminal panicles. Leaves palmate, serrate. Staminal bundles indefinite ... RICINUS.
e. Flowers in axillary or leaf-opposed clusters, rarely panicled or racemed, apetalous. Sepals of male imbricate or calyx shortly toothed. Stamens numerous, central in the flower.
   1. Male-flowers fascicled. Sepals 5. Fruit smooth, indehiscent ... ... GELONIUM.
   2. Male-flowers in panicled cymes. Sepals 4-5. Capsule of three 2-valved cocci ... BALIOSPERMUM.
f. Flowers in axillary spikes or racemes, apetalous. Male calyx valvate. Styles connate. Fruit capsular.
   Racemes androgynous. Male calyx 3-5-partite; female calyx of 5 sepals. Stamens 1-3. Styles spreading above ... ... TRAGIA.

III. Perianth single. Calyx of male minute and open in bud, or obsolete.
   a. Herb with very short leaf opposed bisexual spikes. Annual ... ... SEBASTIANIA.
   b. Trees or shrubs.
      1. Racemes terminal. Male calyx terete, 2-3-lobed. SAPIUM.
      2. Racemes lateral or terminal. Calyx terete, 3-partite. Stamens 3 ... ... EXCOECARIA.
      3. A tree. Flowers monoecious. Male calyx 2-3-lobed ... ... HIPPOMANE.

ACALYPHA.

The genus includes 320 tropical and subtropical species.

The following species are used medicinally in the Philippine Islands—*A. indica* Linn.—; in Madagascar—*A. spiciflora* Burm. f.—; in La Reunion—*A. indica* Linn., *A. integrifolia* Willd.—; in Zululand—*A. peduncularis* Meissn.—; in Southern Rhodesia—*A. petiolaris* Krauss—; in Gold Coast and Nigeria—*A. ciliata* Forsk.—; in Oubanghi-Chari—*A. ornata* Hochst.—; in Indo-China—*A. Evrardii* Gagnep., *A. indica* Linn.—; in the Malay Peninsula—*A. siamensis* Gage—; in India—*A. fruticosa* Forsk., *A. hispida* Burm., *A. indica* Linn., *A paniculata* Miq.—.

A. Herb. Leaves long-petioled, ovate or rhombic-ovate, crenate-serrate ... ... 3. *A. indica.*

B. Shrub.
   a. Leaves ovate-acute or subacute, crenate, glabrous and glandular beneath ... ... 1. *A. fruticosa.*
   b. Leaves broadly rhombic-ovate, at the base shortly cuneate, at the apex cuspidate-acuminate, subacutely and coarsely serrate ... ... 2. *A. hispida.*

c. Leaves long-petioled, ovate-acuminate ... 4. *A. paniculata.*
d. Leaves sub-coriaceous rhomboid narrowed to blunt base, bluntly serrate, tip blunt ... ... 5. *A. siamensis.*

1. **Acalypha fruticosa** Forsk. occurs in the Deccan Peninsula, Ceylon, Pegu, Martaban and Ava. It extends to Arabia and tropical Africa.

The leaves are attenuant and alterative, and an agreeable stomachic in dyspepsia and other ailments. The dose of the infusion of the leaves as ordered by the Vaidyas in Southern India is half a teacupful twice in the day.

The leaves are a Chinese remedy for colic and diarrhœa.

In Arabia the leaves are macerated in water, and children with pustules washed in the liquid.

Arabic: Bortam—; *Canarese*: Chinni—; *Chinese*: Tch'a Iang—; *Deccan*: Chinni—; *French*: Ricinelle—; *Hadie*: Defran—; *Surdud*: Shohat—; *Tamil*: Sinni—; *Telugu*: Chinni—; *Uahfat*: Ansthat—; *Yemen*: Bortom, Defran—.

2. **Acalypha hispida** Burm. is cultivated in Indian gardens.

The leaves are beaten up with green tobacco leaf and an infusion of rice, and applied to inveterate ulcers.

The flowers, boiled in water or administered in the form of a conserve, are said to be specific in diarrhœa and similar disorders.

Malayalam: Vattattali—.

3. **Acalypha indica** Linn. occurs throughout the hotter parts of India and Ceylon. It extends to the Philippine Islands and tropical Africa.

The plant is used as expectorant as a substitute for senega. It has also a diuretic action. It is a useful remedy for bronchitis, asthma and pneumonia; also for rheumatism. It was formerly employed as a purgative and anthelmintic.

The root, bruised in hot water, is employed as a cathartic, and the leaves as a laxative in decoction mixed with common salt. The leaves are used in scabies and, mixed with lime, in other cutaneous diseases.

The powder of the dry leaves is given to children in worm cases, also a decoction prepared from the leaves with the addition of a little garlic. The juice of the same part of the plant, together with that of the tender shoots, is occasionally mixed with a small portion of margosa oil, and rubbed on the tongues of infants for the purpose of sickening them and clearing their stomachs of viscid phlegm.

The expressed juice of the leaves is in great repute, wherever the plant grows, as an emetic for children, and is safe, certain and speedy in its action. Like Ipecacuanha, it seems to have little tendency to act on the bowels or to depress the vital powers, and it decidedly increases the secretion of the pulmonary organs.

A decoction of the leaves is given in ear-ache; a cataplasm of the leaves is applied as a local application to syphilitic ulcers, and as a means of relieving the pain of snake-bite and the irritation caused by the bite of the centipede.

Fresh leaves ground into a paste, made into a ball to the size of a large marble, and introduced into the rectum, are very useful in relieving obstinate constipation of children.

The plant is used in congestive headaches: a piece of cotton is saturated with the expressed juice and inserted into each nostril, relieving head symptoms by causing hæmorrhage from the nose. The powder of the dry leaves is used in bed sores and wounds attacked by worms.

The leaf of this plant is said to be a parasiticide and is applied externally, ground with common salt or quicklime or lime juice. A paste of the leaves with lime juice was prescribed for cases of ringworm (different varieties of cutaneous tinea). In chronic cases it had no effect, but in recent cases it did some good (Koman).

Caius and Mhaskar have had nothing but disappointment with the plant. They found it quite ineffective as an anthelmintic; and the leaves proved useless as an external application in the treatment of snake-bite.

Arabic: Harram-ed-dhibbel—; *Bengal*: Kanda-amadu, Muktajari, Murkanta, Shwetbusunta—; *Bombay*: Khokali, Khokli, Kuppi—; *Canarese*: Chalmari, Kuppi—; *Chinese*: T'ie Han Ts'ai—; *English*: Indian Mercury—; *French*: Bois queue de rat—; *Godavari*: Murkandachettu, Murukonda—; *Gujerati*: Vanchhikanto—; *Hindi*: Khokali, Khokhla, Khokli, Kuppi—; *Indo-China*: Tai tuong xanh—; *Malay*: Rumput lislis—; *Malayalam*: Kuppamani—; *Marathi*: Khajoti, Khokli, Kupi—; *Mauritius*: Herbe chatte, Ortie de l'Inde—; *Philippines*: Bugos—; *Porebunder*: Dadro—; *Sanskrit*: Arittamunjariye—; *Sinhalese*: Kupamenya, Kuppamaniya, Waelkupamenya—; *Tamil*: Kuppaimeni, Kuppamani—; *Telugu*: Kuppaichettu, Kuppintaku, Murkandachettu—; *Uriya*: Indramaris—.

4. **Acalypha paniculata** Miq. is found in the Deccan Peninsula, from Malabar southwards, and in Ceylon; it ascends to 3,000 feet. It is distributed over to Java and tropical Africa.

It is often used as a substitute for *A. indica*.

Aguku: Odukwe—; *Ibo*: Odukwe—; *Yoruba*: Ilewu—.

5. **Acalypha siamensis** Gage is found in sandy open country on the east coast and in the north of the Malay Peninsula, whence it spreads over Siam.

The Malays use the leaves for making tea.

Malay: Tumput—.

ALCHORNEA.

The genus numbers about 50 tropical species, rarest in Asia.

A. cordifolia Muell.-Arg. and *A. hirtella* Benth. are used medicinally in tropical West Africa.

The root of *A. floribunda* Muell.-Arg has properties similar to those of Indian hemp and is much used in the Belgian Congo as a stimulant and narcotic.

Alchornea rugosa Muell.-Arg. is found at Amherst in Burma, in the Andaman Islands and Malacca, extending eastwards to China, the Malay Archipelago and Bouton Straits.

The seeds are used as a purgative in Indo-China.

Indo-China: Bo met, Bo net, Chua mot, Dat mot, Muoi, Soi giai—; *Lao*: Khang poi—.

ALEURITES.

The genus consists of 6 species, inhabiting warm Asia.

A cordata Steud. is used medicinally in China; *A. moluccana* Willd. in India, the Philippine Islands, Madagascar, Brazil and Guiana.

Aleurites moluccana Willd. is typically a seashore plant. It is found wild and planted in the Malay Peninsula, on the sea-coasts and on limestone rocks at 1,000 to 1,500 feet altitude. It is distributed over the Malay and Polynesian islands. The tree is cultivated in India, and very much so in South India.

The oil obtained from the kernels by expression, has been found, in doses from one to two ounces, to act as a mild and sure purgative, producing in from three to six hours after ingestion free bilious evacuations. It was found to approach nearly to castor oil in the mildness and certainty of its operation, but superior to it as having neither taste nor smell, and as producing its cathartic action without any nausea.

In Madagascar and La Reunion the leaves, heated with a flat iron, are applied several times in succession to articulations in cases of acute rheumatism.

Arabic: Jouzebarri, Khasifehindi—; *Bengal*: Akola, Akrot, Jangliakrot—; *Bombay*: Akrod, Jaiphul, Jangliakrot, Janglieranda, Japhal, Jelapa—; *Brazil*: Noz de Bancoul, Noz da India—; *Burma*: Tosikyasi—; *Canarese*: Akroda, Natakrodu—; *Caroline Islands*: Raguar—; *Chinese*: Shih Leih—; *Cutch*: Akrota—; *English*: Belgaum Walnut, Bengal Walnut, Camiri Nut, Candleberry Tree, Candle Nut, Indian Walnut, Singapore Nut—; *French*: Aleurit des Molluques, Bancoulier—; *Guam*: Lumbang, Raguar—; *Gujerati*: Akhoda, Jangli-akhroda—; *Hawaii*: Eboc, Kukui—; *Hindi*: Akola, Akrot, Jangliakrot—; *Hova*: Bakoly, Savoga, Savokara—; *Ilocano*: Balucanag—; *Jamaica*: Country Walnut—; *Kemirih-Malay*: Buaktas—; *La Reunion*: Bancoul, Bancoulier—; *Madagascar*: Mofotra—; *Malay*: Buahkeras, Kanieri—; *Malayalam*: Akrottu, Akshotam, Karankolam—; *Marathi*: Akhod, Japhala, Ranakhrot—; *Mauritius*: Bancoul—; *Persian*: Chaharmaghz-e-hindi, Girdagan-e-hindi—; *Samoa*: Lama—; *Sanskrit*: Akharota, Akhota, Akshota, Asphotaka, Gudashaya, Kandarala, Karparala, Kaureshta, Madanabhaphala, Parvatiya, Phalasneha, Pritakchhada, Bekhaphala, Svadumajja, Vrittaphala—; *Shan*: Kanyin, Mak man yau, Mak yau lik—; *Sinhalese*: Kakkuna, Ratakekuna, Tel-kekuna—; *Tagalog*: Baguilumban, Balocanad, Balucanad, Calumban, Capili, Lumban, Lumbang—; *Tamil*: Nattakkar-ottu—; *Telugu*: Natakrotu, Uduga—; *Urdu*: Akharut—; *Uriya*: Akuroto—; *Visayan*: Rumbang—.

ANDRACHNE.

This genus consists of 15 species, broadly distributed over the tropical and temperate regions of both hemispheres.

A. ovalis Müll.-Arg. is used in South Africa as an anthelmintic and insecticide.

Andrachne cordifolia Müll.-Arg. is found at altitudes of 5,000-8,000 feet in the Central and Western temperate Himalaya, from Nepal westwards to Murree and Afghanistan, The plant is poisonous, and the twigs and leaves are said to kill cattle when browsed in the early morning on an empty stomach.

Beas: Chirmutti, Mutkar, Pin—; *Chenab*: Barsu—; *Garhwal*: Bhatula—; *Jaunsar*: Bharti, Bhartoi—; *Jhelum*: Gurguli, Kurkni—; *Punjab*: Gurguli, Kurkni, Kurkuli—; *Ravi*: Barotri, Madare—; *Sutlej*: Tsatin—.

ANTIDESMA.

This genus includes 90 palaeotropical species.

A. madagascariense Linn. is used medicinally in La Reunion; *A. membranaceum* Muell.-Arg. in Liberia; *A. venosum* E. Mey. in South and tropical West Africa; *A. zeylanicum* Lam. in Ceylon; *A. ghaesembilla* Gaertn. in Cambodia; *A. bunius* Spreng. in India.

A. Ovary tomentose or pubescent ... ... 2. *A. ghaesembilla*.
B. Ovary glabrous.
  a. Leaves 3-6 in. Spikes stout often 4-5 in. ... 1. *A. bunius*.
  b. Leaves 1-3 in. Spikes slender 1-1½ in. ... ... 3. *A. zeylanicum*.

1. **Antidesma bunius** Spreng. is a small evergreen tree found throughout the hotter parts of India, from the Nepal and Sikkim Terai and Assam, southwards to Singapore and Penang; and from Parusnath in Behar to Ceylon. It extends to the Malay Islands and China.

The acid leaves are used in snake-bites; and, when young, they are boiled and used in syphilitic cachexia.

Mhaskar and Caius have demonstrated that the leaves are not an antidote to snake venom.

Burma: Kywepyisin—; *Canarese*: Nayikute—; *Lepcha*: Kantjer—; *Malayalam*: Cherutali, Nulittali—; *Marathi*: Amati—; *Nepal*: Himalcheri—; *Pampangan*: Bignay—; *Philippines*: Bubbugnay—; *Sinhalese*: Karawellakebella—; *Tagalog*: Bignai—; *Tamil*: Nolaidali—; *Telugu*: Anepu, Janupolari—; *Visayan*: Bugnai—.

2. **Antidesma ghaesembilla** Gaertn. is a small tree found in the tropical Himalaya, from Simla to Bhutan and southwards to Ceylon, Singapore, Perak and Penang. It extends to Siam and China, the Malay Islands, Australia and Africa.

The bark, the leaves, and the wood are used medicinally in Cambodia. The bark is considered astringent and tonic. The leaves are finely crushed in a mortar and applied to the fontanel of newly-born babes, and to the head of children suffering from dengue or from a cold with cephalalgia. The wood, or better the young stems with their bark, are used as an emmenagogue.

Cambodia: Dangkiep kdam—; *Canarese*: Pulimpurase, Pullampurasigida—; *Central Provinces*: Jhondri—; *Malay*: Balng ayam, Gunchiak—; *Malayalam*: Cheriyannatam—; *Mundari*: Koetang, Koetangnuetasura, Matasuradaru—; *Telugu*: Janupulisaru, Kondapolari, Lona, Nallaballi, Polari—; *Uriya*: Nihanahari—.

3. **Antidesma zeylanicum** Lam. occurs in the southern Deccan Peninsula, and is common in Ceylon.

A decoction of the leaves is used as a snake remedy; but Mhaskar and Caius have shown experimentally that it is useless as an antidotal as well as a symptomatic treatment.

Sinhalese: Hinembilla—; *Tamil*: Nolaidali—.

APOROSA.

The genus consists of 35 Indo-Malayan species.

Aporosa lindleyana Baill., a much-branched evergreen tree, occurs in the Deccan Peninsula from the Konkan southwards, and is abundant in Ceylon.

A decoction of the root is given in jaundice, fever, headache, insanity, and seminal loss.

Canarese: Sarali—; *Malayalam*: Kotili, Vetti, Vittil—; *Sinhalese*: Baranaembilla, Kebella—; *Tamil*: Kotili, Vittil—; *Tulu*: Sarali—.

BALIOSPERMUM.

This genus consists of 10 Indo-Malayan species.

Baliospermum montanum Müll.-Arg. (= *B. axillare* Bl.) is a stout subherbaceous leafy shrub. It is found in the tropical and subtropical Himalaya, from Kashmir to Bhutan; in Assam and the Khasia Hills down to Chittagong, Pegu, Tenasserim, Burma, and Penang; in the Deccan Peninsula, from Berar and the Konkan to Travancore. It also occurs in Siam and Java.

This plant is much used in Hindu medicine, where purgation is indicated, the root being generally prescribed. This is described as 'pungent, heating; purgative, anthelmintic, diuretic, alexiteric; useful in pains, diseases of the skin and of the abdomen, piles, wounds, enlarged spleen, itching, inflammations, anæmia, leucoderma, jaundice'.

The seeds are used as a drastic purgative, but in overdoses are an acro-narcotic poison; they are sometimes used as a substitute for *Croton Tiglium*. They are also used externally as a stimulant and rubefacient. The oil is a powerful hydragogue cathartic, and is useful for external application in rheumatism. Madden states that to the east of the Sutlej the leaves are in high repute for wounds, and the sap is believed to corrode iron. The root is considered cathartic, and is used in dropsy, anasarca, and jaundice.

A decoction of the leaves is said to be useful in asthma.

Caius and Mhaskar have found the root equally useless in the treatment of snake-bite and of scorpion-sting.

Arabic: Habbussalatinebarri, Habbussalatinesahrai—; *Bengal*: Danti, Hakum, Hakun—; *Berar*: Boa—; *Bombay*: Dantimul, Jamalgota—; *Burma*: Natcho—; *Canarese*: Danti, Kaduharalu—; *Cutch*: Dantimul, Jamalgota—; *Gujerati*: Dantimul, Jamalgota—; *Hindi*: Dante, Danti, Hakum, Hakun—; *Lepcha*: Poguntig—; *Malayalam*: Dantika, Katalavanakku, Nakadanti, Nervalam, Niratimuttu—; *Marathi*: Danti—; *Melghat*: Danti, Jangli jamalgota—; *North-Western Provinces*: Janglijamalgota—; *Persian*: Bedanjirekhatai—; *Sanskrit*: Amukheti, Anukula, Bhadra, Danti, Dantika, Erandapatri, Erandaphala, Gunapriya, Jayapala, Kumbhi, Madhupushpa, Makunaka, Nagadanti, Nagasphota, Nepala, Nikumbhi, Nishalya, Nishkumbha, Pratyakparni, Raktadanti, Rechani, Ruksha, Shighra, Shwetaghanta, Shyenaghanta, Taruni, Udumbaraparni, Upachitra, Varahangi, Vishalya, Vishodhini—; *Tamil*: Kattamanakku, Niradimuttu, Nirettimuttu, Peyamanakku—; *Telugu*: Ettadundiga, Kanakapata, Kondamudamu, Nelajidi—; *Uriya*: Donti—.

BISCHOFIA.

The only species of this genus, **B. javanica** Bl., is a large evergreen tree occurring in the sub-Himalayan forests and outer hills, spreading over Chota Nagpur, Assam, Burma, Chittagong, and the Western Peninsula. It is found in the Malay and the Pacific Islands.

In Assam the juice of the leaves is considered a cure for sores.

Assam: Uriam, Uriana—; *Bombay*: Bok—; *Burma*: Aukhyu, Pogaungza, Yepadauk—; *Cagayan*: Toogan—; *Canarese*: Gobranerul, Goparimgurulle, Govarnellu, Nigurulle, Nile, Nilimara—; *Dehra Dun*: Paniala—; *English*: Java Cedar, Vinegar Wood—; *Formosa*: Ka-tang—; *Garhwal*: Kaen, Kanji, Kot semla—; *Haldwani*: Pankoen—; *Hindi*: Bhillar, Irum, Kain, Kein, Kotsemba, Paniala, Pankain—; *Igorrote*: Tuel—; *Ilocano*: Quitaquita—; *Kadir*: Naunal, Nira, Tirippu—; *Kumaon*: Koen—; *Lepcha*: Sa-nong kung—; *Malayalam*: Nira, Tirippu—; *Malkot*: Billar—; *Mundari*: Daruhajam, Hajam—; *Nilgiris*: Red Cedar—; *Oudh*: Irum—; *Philippines*: Canarem, Dueg, Tua—; *Santali*: Pader—; *Saora*: Panta—; *Tagalog*: Dampol, Toa, Toob, Tooc, Toog—; *Tamil*: Madagirvembu, Milachadayan, Milachittyan, Tondi—; *Telugu*: Nalupumushti—; *Tharu*: Areng—; *Uriya*: Dingiri—; *Visayan*: Tooc—.

BREYNIA.

This genus consists of 12 species, found in Africa, Asia and Polynesia.

Calyx greatly enlarged in fruit ... ... 1. *B. patens.*
Calyx not or scarcely enlarged in fruit ... ... 2. *B. rhamnoides.*

1. **Breynia patens** Rolfe is found in the tropical Himalaya from Nepal to Mishmi, in Assam, Chittagong, Burma, the Western Peninsula, and Ceylon.

The plant is astringent to the bowels. The juice of the stem is given in conjunctivitis.

Gujerati: Kamboi, Kedakamboi, Khedakamboi—; *Hindi*: Kalamahomad, Kambhi—; *Malayalam*: Peruniruri—; *Marathi*: Kalichikali—; *Porebunder*: Kali-kamboi, Kamboi—; *Sanskrit*: Bahupraja, Bahupushpa, Devadaru, Kamboji—; *Saora*: Kintaipude—; *Telugu*: Devadari—; *Uriya*: Deulopohora, Jajan, Medhokotahotoru—.

2. **Breynia rhamnoides** Müll.-Arg. is found throughout tropical India, Ceylon, and the Malay Peninsula; extending to the Malay and the Philippine Islands, and China.

The bark is astringent. In Behar the dried leaves are smoked like tobacco, in cases in which uvula and tonsils are swelled.

Canarese: Bamari, Gandupachcheri, Huli, Kadunugge, Karisuli, Kempehuli, Kempuhili, Suli—; *Ceylon*: Manippulanti—; *Hindi*: Surasaruni—; *Malay*: Suruyian—; *Malayalam*: Chuvannaniruri, Kattuniruri, Pavilappula—; *Oudh*: Tikkar—; *Sanskrit*: Aruin—; *Santali*: Kadrupala, Karki—; *Sinhalese*: Gaskayila—; *Tamil*: Kattuniruri, Manippulanji, Pavalappul, Pavalappula, Pamari, Sigappuppula—; *Telugu*: Ettaballi, Ettapurugudu, Nagalipachchari, Pagadapu, Pagadurugudu, Vellari, Yellari—; *Uriya*: Jajan—.

BRIDELIA.

This genus includes 60 species, spread over the tropics and subtropics of the Old World.

B. cambodiana Gagnep. is used medicinally in Cambodia, *B. schlechteri* Hutch. in South Africa; *B. atroviridis* Muell.-Arg., *B. ferruginea* Benth. and *B. micrantha* Baill. are used in Nigeria and in Gold Coast; *B. montana* Willd. and *B. retusa* Spreng, in India.

Leaves membranous ... ... 1. *B. montana.*
Leaves rigidly coriaceous ... ... 2. *B. retusa,*

1. **Bridelia montana** Willd. is found in the sub-Himalayan tract from the Jhelum eastwards; it also occurs in the Khasia Hills, the Central Provinces, Bihar, Orissa, and Upper Burma.

The root and the bark are much used as an astringent medicine in Bombay and Goa.

The plant has been credited with anthelmintic properties.

Assam: Kaisho—; *Bombay*: Asano—; *Canarese*: Kittoe, Sidigulige—; *Cutch*: Asana—; *Garhwal*: Gaya—; *Goa*: Faturfoda—; *Gujerati*: Asano—; *Hindi*: Geia, Gondni, Kargnalia, Khaja, Kusi—; *Khond*: Balli—; *Kumaon*: Kurgnulia—; *Marathi*: Asana—; *Mundari*: Karakadaru—; *Nepal*: Geio—; *Saharanpur*: Gondni—; *Tamil*: Vengaimaram—; *Telugu*: Gundubigalu, Panchavoni, Pantangi, Pantegi, Pantiga, Patunga, Sannakodari, Tellavegisa—; *Uriya*: Marda, Nuanali—.

2. **Bridelia retusa** Spreng. is found throughout India, and Ceylon, Burma and Malacca.

The root and the bark are valuable astringents.

Hindu practitioners in Western India use the bark for the removal of urinary concretions.

The bark is used as a liniment with gingelly oil in rheumatism.

Ajmere: Lamkana—; *Assam*: Kohir—; *Banswara*: Angnera—; *Bengal*: Kasai, Kosai—; *Betul*: Kasai, Sankana—; *Bhil*: Asana, Gunjan, Katiain—; *Bhumij*: Karika—; *Bombay*: Asauna, Assana, Phatarphod—; *Burma*: Seikche, Seikchi, Seikgyi, Tseichyi—; *Canarese*: Asana, Garige, Goje, Gojji, Guju, Gurige, Gworgie, Havugandha, Kogyamunji, Maguva, Muljane, Mullahonne, Mullubenga, Mulluhonne, Nasinagandha, Nasinage, Phatterphodi, Siruhonne—; *Central Provinces*: Karka, Kassei, Kassi—; *Chittagong*: Kamkui—; *Deccan*: Sun—; *Dehra Dun*: Gaya, Khaja—; *Garhwal*: Gauli, Gaya, Khaja—; *Garo*: Kashi—; *Gond*: Kassei—; *Gujerati*: Asana, Ekalakanto, Monj—; *Hindi*: Gauli, Kaj, Kajja, Kassi, Khaja—; *Ho*: Kaka—; *Kalagarh*: Goli—; *Kharwar*: Kaj, Kaji, Kanj—; *Khond*: Rugendi—; *Kolami*: Kaka, Kharaka—; *Konkani*: Kongy—; *Kurku*: Karka, Karkha—; *Lambadi*: Makhiro—; *Lepcha*: Pengji—; *Malayalam*: Chalaru, Komanji, Mullukayani, Mulluvenya, Mulluvenna—; *Mandevi*: Haklo—; *Marathi*: Asana, Asanakutgi, Gunjan, Kantakauchi, Katiain, Katiyen, Kutki, Palapasana, Patharaphoda, Phatharaphoda—; *Matheran*: Asana, Hasana, Palehasan, Phatarphod—; *Mechi*: Katakuchi—; *Monghyr*: Kuj—; *Mundari*: Karaka—; *Nepal*: Geio—; *Nimar*: Kasai, Sankana—; *Portuguese India*: Bentka—; *Punjab*: Mark, Pathor—; *Rajbanshi*: Nanda—; *Rajputana*: Angnera, Lamkana—; *Ramnagar*: Goli—; *Reddi*: Annemu—; *Saharanpur*: Ekdania, Gondni—; *Sanskrit*: Asana, Ekadivī, Ekavira, Mahavira, Sakridvira, Suvarika—; *Santali*: Kadrupala—; *Saora*: Annemu—; *Sinhalese*: Kattakaala, Ketakala, Ketakele—; *Tamil*: Adamarudu, Asuvai, Kadugai, Komanji, Malaivengai, Mullumarudu, Mulluvengai, Mulvengai, Sem, Singattan, Siruvengai—; *Telugu*: Annemu, Bontavegita, Duriyamaddi, Ettapattaka, Kodaratti, Koramaddi, Koramanu, Kosengi, Peddayanemu, Poramanu, Selaka—; *Tharu*: Khooj—; *Tinnevelly*: Adamaradu—; *Tulu*: Mullugunje—; *Uriya*: Kasai, Kasi, Kosai, Kosi, Panikasi—.

BUXUS.

The genus consists of 25 species, inhabiting the temperate regions of the Old World.

B. balearica Lam. is used medicinally in Majorca, *B. sempervirens* Linn. in Europe and North America.

Buxus sempervirens Linn. occurs in the temperate Himalaya, from Kumaon to Simla and Bhutan at 5,000-9,000 feet, and on the Salt Range in the Punjab. Westwards it extends to North Africa, and to western and southern Europe, where it abounds in limestone districts. Northwards it extends to western Siberia, Turkestan, China and Japan.

Yunani practitioners use both the leaves and seeds:—'The leaves are good for headache, pain, prolapsus ani. The seeds are bitter, astringent, tonic to the heart and brain; used in stomatitis, to dry the bad humours of the liver'.

The wood in its native countries is considered diaphoretic, being given in decoction as an alterative for rheumatism and secondary syphilis. It is used as a substitute for guaiacum in the treatment of venereal disease when sudorifics are considered to be the correct specifics.

Boxwood has been found narcotic and sedative in full doses; emetico-cathartic and convulsant in overdose. The tincture was formerly used as a bitter tonic and antiperiodic, and had the reputation of curing leprosy.

A volatile oil distilled from the wood has been prescribed in cases of epilepsy. The oil has been employed for piles and also for toothache.

The leaves, which have a nauseous bitter taste, have sudorific, alterative, and cathartic properties; they are given in powder, in which form they are also an excellent vermifuge.

Various extracts and perfumes were formerly made from the leaves and bark. A decoction was recommended as an application to promote the growth of the hair.

Dried and powdered, the leaves are still given to horses for the purpose of improving their coats. The powder is regarded by carters as highly poisonous, to be given with great care. In Devonshire, farriers still employ the old remedy of powdered Box leaves for bot-worms in horses.

In some parts of Europe Box is one of the active ingredients in a cure for the bite of a mad dog.

Camels readily eat the leaves; but they are poisoned by them.

The bark of the root is officinal in Portugal.

Afghanistan: Shandalaghune—; *Arabic*: Bakas—; *Catalan*: Boix—; *Dutch*: Boxboom, Palm, Palmboom—; *English*: Box Tree, Dudgeon, Evergreen Box—; *French*: Bois bénit, Buis, Buis commun, Ozanne—; *German*: Buchsbaum—; *Greek*: Pyxos—; *Italian*: Bosso, Bossolo, Busso, Buxo, Mortella—; *Jaunsar*: Papri, Sansadu—; *Kashmir*: Chikri—; *Kumaon*: Papri—; *Mashudi*: Shamshath—; *North America*: Box-tree, Bush-tree, Common Box, Dudgeon—; *North-Western Himalayas*: Chikri, Papri, Poppar, Sansadu, Shamshad—; *Persian*: Shamshad—; *Portuguese*: Buxo—; *Punjab*: Chikri, Papar, Paprang, Papri, Papur, Shamshad, Shumaj—; *Roumanian*: Cimisu, Cimsu, Merisor tureesc—; *Russian*: Buksus, Samshit—; *Spanish*: Boj—; *Swedish*: Buxbom—; *Urdu*: Shamshad—.

CHROZOPHORA.

This genus consists of 11 species, natives of the Mediterranean region, tropical Asia and tropical Africa.

C. plicata A. Juss. is a poison with acrid properties. *C. senegalensis* A. Juss. is used medicinally in Northern Nigeria.

A prostrate herb. Stamens 15 in two whorls. Ovary and capsule with stellate tomentum and silvery scales. 2. *C. rottleri*.

A procumbent stellately woolly herb. Ovary and capsule with stellate tomentum but without silvery scales ... 1. *C. prostrata*.

1. **Chrozophora prostrata** Dalz. is found throughout India: the Punjab, the Upper Gangetic Plain, Bihar, Gujerat, Konkan, Deccan, North Kanara, Sind, Central and South India. It extends westwards to North Africa and Spain.

The ashes of the root are given to children for cough. The leaves are considered depurative. The seeds are used as purgative.

The Santals mix the root with that of *Carissa Carandas* for blistering purposes.

Bengal: Khudiokra—; *Chinese*: Pa Teou Nan—; *French*: Bancoulier—; *Gujerati*: Betookharada, Okharada—; *Hindi*: Shadevi, Sonballi, Subali—; *Punjab*: Nilakrai, Nilkhanti, Putkhanda—; *Sanskrit*: Suryavarta—; *Santal*: Pangonari—; *Sind*: Shadevi, Sonballi, Subali—; *Tank*: Nealboti—; *Telugu*: Guruguchettu, Lingamiriyam—.

2. **Chrozophora rottleri** A. Juss. occurs through the whole of India. It extends to Afghanistan and thence to the Mediterranean region.

The plant has emetic, drastic, and corrosive properties. The seeds are used as a cathartic.

Afghanistan: Kapochist—; *English*: Turnsole—; *French*: Morelle à indigo—; *Gujerat*: Kalookharad—; *Hindi*: Shadevi, Sonballi, Subali—; *Marathi*: Suravarta—; *Punjab*: Kukronda, Nilan, Tappalbuti—; *Sanskrit*: Suryavarta—; *Sind*: Shadevi, Sonballi, Subali—; *Spanish*: Tornasol—.

CICCA.

C. disticha Linn. (=*Phyllanthus distichus* Müll.-Arg.) is cultivated in India and the Malay Peninsula. It occurs in the Malay Islands and in Madagascar.

The root and the seed are cathartic. The fruit is acid and astringent.

The juice of the root-bark is used as a poison, often for criminal purposes. It produces headache, sleepiness, and death accompanied by severe abdominal pains.

Bengal: Hariphal, Hariphul, Loda, Noari—; *Bombay*: Harparawri, Raiavala—; *Burma*: Thimbawzibyu, Thinbawniyu, Thinbozihpyu—; *Canarese*: Aranelli, Karinelli, Kirinelli, Kirunelli, Rayaranelli—; *English*: The Country Gooseberry, Star Gooseberry—; *French*: Brignolier—; *Goa*: Cherambola—; *Hindi*: Chatmeri, Harfarauri, Nuree, Nurphal—; *Konkani*: Rojanvalli, Rosanvalli—; *La Reunion*: Cherimbelier—; *Malay*: Chermela—; *Malayalam*: Arinelli, Nellipuli—; *Mauritius*: Chérimbolier—; *Pampangan*: Iba—; *Sanskrit*: Ghana, Komalavalkala, Lavali, Lavalippala, Lavani, Pandu, Skandhaphala, Srigdha, Sugandhamula—; *Sinhalese*: Ratanelli—; *Tagalog*: Bangquiling, Banquilin, Iba, Yba—; *Tamil*: Arunelli, Sadadaram, Sadagam—; *Telugu*: Rachayusirika, Ratsavusiriki—; *Tulu*: Karinelli—; *Urdu*: Harpharuri—; *Uriya*: Aurakuli, Bungarada, Narokoli—; *Visayan*: Bangquiling, Layohan, Poras—.

CLEISTANTHUS.

The genus includes 110 African and Indo-Malayan species.

Cleistanthus collinus Benth. occurs in Bihar, Chota Nagpur, the Satpura Range, the Chanda District, and the Western Peninsula. It is rare in Ceylon.

The plant is poisonous. An extract of the leaves and fruit acts as a violent gastro-intestinal irritant.

In Chota Nagpur the fruit and bark are employed to poison fish; the latter is also considered a useful application in cutaneous diseases. For severe headache, the head and upper part of the body are bathed in water in which the leaves have been steeped. The Mundas throw the leaves, dried and pounded, into pools and ponds to kill fish.

Berar : Ghara—; *Canarese* : Badedarige, Bodadaraga, Kadagargari, Kodasige—; *Central Provinces* : Ganari, Garar, Garari—; *Gond* : Garari—; *Hasada* : Parasudaru—; *Hindi* : Garari, Garrar, Karla—; *Ho* : Pasu—; *Kharwar* : Kargali, Kergali—; *Khond* : Kadise—; *Kolami* : Larshuter, Parasu, Pas, Pasu—; *Malayalam* : Nilappala—; *Marathi* : Garari—; *Mundari* : Kargelung, Parasu—; *Naguri* : Kargelodaru, Kargelungdaru—; *Sanskrit* : Indrayava, Kaudigam, Kutaja, Nandi—; *Santali* : Kargali, Kargalli—; *Tamil* : Nilaippalai, Odaichi, Odan, Odishi, Odu, Odugu, Oduppai, Oduvan—; *Telugu* : Kadise, Korshe, Korsi, Vadise—; *Uriya* : Karada, Koroda, Korora—.

CROTON.

This genus includes 600 species, inhabiting all tropical and subtropical countries.

The 'Crotons' of gardens do not belong to this genus, but to the genus *Codiaeum* of Papua and Polynesia.

The following species are used medicinally in China, Malaya, the Philippine Islands—*C. Tiglium* Linn.—; in Indo-China— *C. argyratus* Bl., *C. Cumingii* Müll.-Arg., *C. maieuticus* Gagnep., *C. oblongifolius* Roxb., *C. poilanei* Gagnep., *C. Tiglium* Linn., *C. tonkinensis* Gagnep.—; in North America— *C. californicus* Müll.-Arg.—; in Mexico — *C. dioicus* Cav., *C. draco* Cham. and Schlecht., *C. niveus* Jacq., *C. vulpinus* Sesse and Moq.—; in Venezuela and Colombia— *C. leptostachyus* H. B. and K., *C. malasubo* Karst.—; in Peru— *C. suberosus* H. B. and K.—; in Brazil— *C. antisiphiliticus* Mart., *C. campestris* St. Hil., *C. fulvus* Mart.—; in Guiana— *C. origanifolius* Lam.—; in the West Indies— *C. cascarilla* Benn., *C. eluteria* Benn., *C. flavens* Linn., *C. glabellus* Linn., *C. lucidus* Linn.—; in Gambia and Nigeria— *C. amabilis* Muell.-Arg., *C. lobatus* Linn.—; in Gold Coast— *C. lobatus* Linn., *C. penduliflorus* Hutch—; in East Africa— *C. elliotianus* Baill., *C. gubouga* S. Moore; in Southern Africa— *C. gratissimus* Burch., *C. gubouga* S. Moore, *C. sylvaticus* Hochst.—; in Madagascar— *C. macrobuxus* Baill.—.

A. Inflorescence lepidote.
  a. Leaves densely lepidote beneath
    1. A tree ... ... 1. *C. argyratus.*
    2. A shrub.
      i. Petiole $\frac{1}{2}$-$1\frac{1}{2}$ in. Stamens 15-18. Capsule $\frac{1}{2}$ in. long, broadly oblong ... ... 5. *C. reticulatus.*
      ii. Petiole $\frac{3}{4}$ in. Stamens 12-15. Capsule $\frac{1}{4}$ in. long, scaly ... ... 3. *C. Cumingii.*
  b. Leaves glabrous when old ... ... 4. *C. oblongifolius.*
B. Inflorescence stellately tomentose or glabrous.
  a. Leaves 3-5-plinerved at the base, scabrid or softly pubescent with stellate hairs beneath ... 2. *C. caudatus.*
  b. Leaves strongly triple-nerved ... ... 6. *C. Tiglium.*

1. **Croton argyratus** Bl. is a small evergreen tree, common in the forests and woods of Burma, Malaya, Sumatra, Java, and Borneo.

In Indo-China the leaves are infused for a digestive tea.

Indo-China: Bac la, Day mang—; *Malay*: Cherit badak, Mungke, Simmungke—.

2. **Croton caudatus** Geisel is found in the Eastern Himalaya, in Assam and Bengal down to the Deccan, Malacca, and Ceylon; extending to Java and the Philippine Islands.

The leaves are applied as a poultice to sprains.

In Lakhimpur the young leaf buds are powdered with the leaves of *Caesalpinia sappan* and used for liver diseases.

Bengal: Nanbhantur—; *Lakhimpur*: Latamahundi—; *Lepcha*: Tackchabrik—; *Malay*: Akar guroh periat, Akar tuku takal—; *Uriya*: Pholancokriti, Sanaushnota, Wusta—.

3. **Croton Cumingii** Müll.-Arg. is a straggling shrub found on rocks, usually limestone, throughout the Malay Peninsula, Siam, Indo-China, and the Philippine Islands.

The plant is used medicinally in Annam.

Indo-China: Co chu lon—.

4. **Croton oblongifolius** Roxb. is found in Sylhet, Bengal, Chota Nagpur, the Central Provinces, Burma, the western Peninsula, and Ceylon.

The seeds and fruits are purgative.

The Goanese and the inhabitants of Southern Konkan administer the bark in chronic enlargements of the liver and in remittent fever. In the former disease, it is both taken internally and applied locally. As an application to sprains, bruises, rheumatic swellings, etc., it is in great request.

In the Southern Konkan, it has a reputation as a remedy in snake-bites.

The Santals use the bark and root as a purgative and as an alterative in dysentery.

The roots enter into the composition of pills used by the Mundas of Chota Nagpur for chronic rheumatism. The root bark is given in small doses as a purge; a larger quantity is said to be poisonous.

The leaves are used externally in Cambodia for liver complaints and scabies. The leaves are often boiled in water, and the liquid applied hot to the itch.

The root, bark, and seeds are equally useless in the antidotal and symptomatic treatment of snake-bite; the root is useless as an external application (Mhaskar and Caius).

Assam: Burmaparokupi—; *Bengal*: Baragach, Putri—; *Bombay*: Ganasuar, Gunsur—; *Burma*: Theyin, Thityin—; *Cambodia*: Trapung—; *Goa*: Gonsur—; *Hindi*: Buragach—; *Indo-China*: Cui den, Tra poung—; *Kharwar*: Bhain swan—; *Koderma*: Maisonda—; *Kolami*: Konya, Kuli, Kurti, Kutikonyer, Poter—; *Lohardugga*: Putri—; *Malay*: Kote, Putol—; *Mal Paharia*: Putol—; *Marathi*: Ganasura, Gunsur—; *Mundari*: Kuti, Kutidaru—; *Nepal*: Ach—; *Oudh*: Arjunna—; *Patna*: Chucka—; *Sanskrit*: Bhutankusa—; *Santali*: Gote—; *Tamil*: Milgunari—; *Telugu*: Bhutalabhairi, Bhutankusamu—; *Tharu*: Mahson—; *Uran*: Poter—; *Uriya*: Masundi—.

5. **Croton reticulatus** Heyne is found in the Deccan Peninsula, from the Konkan southwards. It also occurs in the Central Province of Ceylon.

The bark is used as a bitter stomachic.

Bombay: Panduray—; *Marathi*: Pandhari, Pandharisala—; *Matheran*: Pandhri, Pandurai—.

6. **Croton Tiglium** Linn. is found naturalized and cultivated in Bengal, Assam, and southwards to Burma, Malacca, and Ceylon. It extends to the Malay Islands and Ceylon.

According to Ayurveda the fruit and the seed are purgative; and the oil from the seed is purgative, carminative, useful in diseases of the abdomen, mental troubles, convulsions, fever, insanity, inflammations, bronchitis.

According to Yunani practitioners the seeds have a bitter bad taste, causing a burning sensation; cathartic, expectorant, emetic; good in sore eyes, excessive phlegm, leucoderma.—The oil is cathartic, tonic; removes pus and bad matter from the body.

The seeds and the oil are officinal and their properties are well known: irritant, rubefacient, cathartic. The seeds are officinal in Finland and Portugal; the oil is officinal in Austria, Belgium, Beazil, Denmark, France, Germany, Great Britain, Japan, Mexico, Norway, Russia, Spain, Switzerland, the United States, and Yugoslavia.

In Lakhimpur the seeds are ground in water, and the infusion is used to kill insect pests.

The fruits are employed by Dayaks in Borneo to poison fish. The root is used in Kelantan as an abortifacient.

On account of their drastic purgative properties the seeds and oil are regarded by the Chinese as entirely poisonous. The bark is used as a tonic in Annam.

Caius and Mhaskar gave two adult males one minim of croton oil in one dose. The patients had several motions, but passed no worms though they were ultimately found to have been harbouring 356 hookworms. These same workers found that the seeds are not an antidote to snake venom, and that they are useless as a collyrium in the treatment of snake-bite or as an external application to the sting of the scorpion; they also demonstrated that the leaves have no action when applied externally to the site of the bite from a poisonous snake.

Annam: Ba dau—; *Arabic*: Batu, Dand, Datun, Habbussalatin—; *Bengal*: Jamalgota, Jaypal, Jhayal, Rechuk—; *Bombay*: Jaipa, Jaipal, Jamalgota—; *Burma*: Kanako—; *Canarese*: Danti, Japala, Jayapala, Nepala—; *Chinese*: Pa Teou, Pa Teou Seou, Pa Tou—; *Deccan*: Jamalgota—; *English*: Purging Croton—; *French*: Bois des Molluques, Bois de Pavana, Bois de Pavanna, Bois purgatif, Graine de Tilly, Graine de Moluques, Petit pignon d' Inde—; *Gujerati*: Nepal—; *Hamadan*: Habb-el-salatin—; *Hindi*: Jamalgot, Jamalgota— *Indo-China*: Ba dau, Ba tau, Bat khlot, Cong khoi—; *Italian*: Grana tiglio—; *Japan*: Hazu—; *Java*: Cheraken—; *Lakhimpur*: Kanibhi—; *Malay*: Chemkian, Chengkian—; *Malaya*: Bori, Pai Tow—; *Malayalam*: Dantibijam, Katalavanakku, Nirvalam—; *Marathi*: Jamalagota, Jepal, Jeyapal—; *Mauritius*: Croton tilly, Tilly—; *Persian*: Badanjirekhatai, Bidendjirehkhatai, Dund, Habbdilmaluk, Habbelkhatai—; *Portuguese*: Croton tiglio—; *Sanskrit*: Danti, Jayapala, Nepala—; *Sinhalese*: Jayapala, Nepalam—; *Tagalog*: Camaisa, Tuba, Tubacamaisa—; *Tamil*: Kattukkattai, Naganam, Nagandi, Nervalam, Nigumbam, Nirvalam, Sambari, Sayabalam, Sevalangottai, Siduram, Sittudu, Tendi—; *Telugu*: Nepalamu, Nepalavemu—; *Tulu*: Berada, Byaribittu—; *Uriya*: Jaipalo Joyopalo, Konika—; *Visayam*: Camarandag, Macasla, Tubasabuquid—.

EUPHORBIA.

The genus comprises 750 species, inhabiting chiefly subtropical and warm temperate countries. It is very various in habit. Some species have a fleshy angular stem, furnished with spines, resembling that of a Cactus; these species yield by incision a resinous juice which is strongly drastic, and used externally as a vesicant. The other Euphorbias, which have a normal stem and leaves, have a purgative milky juice; some are considered efficacious in syphilitic cachexia; others are emetic, or slightly astringent and aromatic, or astringent and slightly narcotic.

The following species are used medicinally in Europe— *E. amygdaloides* Linn., *E. Chamaesyce* Linn., *E. Characias* Linn., *E. Cyparissias* Linn., *E. Esula* Linn., *E. Gerardiana* Jacq., *E. helioscopia* Linn., *E. hyberna* Linn., *E. Lathyris* Linn., *E. Myrsinites* Linn., *E. palustris* Linn., *E. Peplis* Linn., *E. Peplus* Linn., *E. resinifera* Berg., *E. serrata* Linn.—; in the Mediterranean region— *E. aleppica* Linn., *E. Apios* Linn., *E. dendroides* Linn., *E. Peplis* Linn., *E. spinosa* Linn.—; in Arabia— *E. antiquorum* Linn., *E. officinarum* Linn.—; in China— *E. adenochlora* Morr. and Dcne., *E. helioscopia* Linn., *E. humifusa* Willd., *E. Lathyris* Linn., *E. pekinensis* Rupr., *E. Sieboldiana* Morr. and Dcne.—; in Indo-China: *E. antiquorum* Linn., *E. Atoto* Forst., *E. Chamaesya* Linn., *E. edulis* Lour., *E. hirta* Linn., *E. hypericifolia* Linn., *E. neriifolia* Linn., *E. parviflora* Linn., *E. rosea* Retz, *E. thymifolia* Linn., *E. Tirucalli* Linn.—; in Malaya— *E. Lathyris* Linn., *E. pekinensis* Rupr., *E. Sieboldiana* Morr. and Dcne.—; in the Philippine Islands— *E. hirta* Linn., *E. neriifolia* Linn., *E. Tirucalli* Linn.—; in Australia— *E. Drummondii* Boiss.—; in Fiji— *E. hirta* Linn.—; in North America— *E. albomarginata* Torr. and Gray, *E. coralloides* Linn., *E. corollata* Linn., *E. hirta* Linn., *E. humistrata* Engl., *E. Ipecacuanha* Linn., *E. Lathyris* Linn., *E. maculata* Linn., *E. marginata* Pursh., *E. ocellata* Durand, *E. Preslii* Guss., *E. serpyllifolia* Pers.—; in the West Indies— *E. buxifolia* Lam., *E. linearis* Retz, *E. pulcherrima* Willd.—; in Mexico— *E. glyptosperma* Linn., *E. prostrata* Ait., *E. pulcherrima* Willd.—; in Peru— *E. laurifolia* Lam., *E. pulcherrima* Willd.—; in Chile— *E. portulacoides* Linn.—; in Brazil— *E. brasiliensis* Lam., *E. caecorum* Mart., *E. cotinifolia* Linn., *E. heterodoxa* Muell.-Arg., *E. hypericifolia* Linn., *E. papillosa* St. Hil., *E. phosphorea* Mart.—; in Guiana— *E. cotinoides* Miq., *E. hirta* Linn., *E. hypericifolia* Linn., *E. punicea* Sw.—; in the West Indies— *E. hirta* Linn., *E. pulcherrima* Willd.—; in the Canary Islands and in Guinea— *E. balsamifera* Ait., *E. canariensis* Linn.—; in West Africa— *E. aegyptiaca* Boiss., *E. balsamifera* Ait., *E. convolvuloides* Hochst., *E. hirta* Linn., *E. kamerunica* Pax, *E. lateriflora* Schum. and Thonn., *E. leonensis* N. E. Br., *E. Poissonii* Pax, *E. polycnemoides* Hochst.—; in Abyssinia— *E. cerebrina* Hochst.—; in Ethiopia— *E. officinarum* Linn.—; in Madagascar— *E. anagalloides* Bak., *E. Bojeri* Hook., *E. emirnensis* Bak., *E. erythroxyloides* Bak., *E. hirta* Linn., *E. splendens* Boj., *E. trichophylla* Bak.—; in La Reunion— *E. dissimilis* Cordem., *E. goliana* Lam., *E. heyneana* Boiss., *E. hirta* Linn., *E. hypericifolia* Linn., *E. Peplus* Linn., *E. prostrata* Ait., *E. thymifolia* Burm., *E. Tirucalli* Linn.—; in Southern Africa— *E. abyssinica* J. F. Gmel., *E. basutica* Marl., *E. bupleurifolia* Jacq., *E. clavarioides* Boiss., *E. helioscopia* Linn., *E. ingens* E. Mey., *E. mauritanica* Linn., *E. procumbens* Mill., *E. restituta* N. E. Br., *E. sanguinea* Hochst. and Steud., *E. striata* Thunb., *E. truncata* N. E. Br., *E. virosa* Willd.—.

E. Candelabrum Tremaut, *E. mauritanica* Linn., *E. striata* Thunb., and *E. virosa* Willd. are used as arrow poisons by the Bushmen of Southern Africa; *E. sapini* de Wild. is similarly used by the tribes of Oubanghi-Chari.

The latex of *E. canariensis* Linn. is officinal in Portugal and Spain; that of *E. resinifera* Berg. in Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Hungary, Italy, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, and Yugoslavia.

A. Herbs, rarely shrubby below; prostrate or ascending. Leaves all opposite. Glands 4-5, usually furnished with a membranous petaloid limb.

- I. Erect or decumbent branching herbs or shrubs, with leaves ⅓-⅔ in. long or thereabouts. Involucres in axillary and subterminal cymes or crowded in the uppermost leaves. Limb of gland conspicuous though small.
  - a. Glabrous. Stem stout swollen at the nodes ... 2. *E. Atoto.*
  - b. Glabrous or sparsely pubescent
    - 1. Annual. Seeds smooth or with broad shallow transverse pits ... ... 7. *E. hypericifolia.*
    - 2. Perennial. Seed rugose ... ... 12. *E. rosea.*
  - c. Hispid with copious crisped hairs ... ... 6. *E. hirta.*
- II. Prostrate, rarely erect plants, with leaves ⅙-⅓ in. long, rarely more. Involucres solitary, or in very short subsessile cymes, usually crowded along one side of the stem, or of short lateral branches. Limb of gland obscure or absent.
  - a. Stems hispidly hairy. Capsules pubescent or hirsute.
    - 1. Leaves crenulate. Capsules pubescent. Seeds furrowed ... ... 16. *E. thymifolia.*
    - 2. Leaves entire. Capsules hirsute. Seeds pitted ... ... 4. *E. granulata.*
  - b. Stems glabrous. Capsules glabrous.
    - 1. Leaves nearly as broad as long. Seeds smooth ... ... 9. *E. microphylla.*
    - 2. Leaves from a very unequal base, elliptic-rhomboid, very obtuse ... ... 14. *E. sanguinea.*
  - c. Stems glabrous or short-hairy ... ... 19. *E. turcomanica.*

B. Shrubs or trees with fleshy terete ribbed angled or flattened stems and branches. Leaves absent or alternate or the upper opposite.

- I. An erect unarmed shrub or tree. Branches spreading, cylindric, scattered, whorled or clustered. Leaves absent or few small linear-oblong ... ... 17. *E. Tirucalli.*
- II. Erect shrubs or trees, with stout angled ribbed or winged branches that are crenate or nodose at the angles or wings, and there provided with 2 or 3 stipular prickles.
  - a. Pairs of stipular spines on tubercles or swellings of the branchlets ... ... 10. *E. neriifolia.*

b. Pairs of stipular spines on flat brown or black corky areas, not on swellings of the branchlets. 11. *E. nivulia.*
c. Pairs of stipular spines in the sinuses of the thick sinuate wings .... 1. *E. antiquorum.*
d. Pairs of stipular spines on the margins of the thick obtuse undulate wings ... ... 13. *E. Royleana.*
e. Pairs of stipular spines on the lobes of the lobulate wings ... ... 18. *E. trigona.*

C. Herbs, rarely shrubby below, usually erect. Leaves alternate, upper opposite.
I. Involucral glands transversely oblong with rounded margins.
a. Perennial herbs.
1. Capsule smooth. Plant quite glabrous ... 15. *E. Thomsoniana.*
2. Capsule warted. Plant glabrous or sparsely hairy ... ... 8. *E. longifolia.*
b. Annuals. Capsule smooth. Seeds pitted ... 5. *E. helioscopia.*
II. Involucral glands truncate retuse or 2-cornate. Annuals. Seeds oblong leprous ... ... 3. *E. dracunculoides.*

1. **Euphorbia antiquorum** Linn. occurs throughout the hotter parts of India and Ceylon, in dry places, ascending to 2,000 feet. It is common all over Burma, being often cultivated for hedges. It is found on the limestone rocks of the Malay Peninsula, where the plant is also cultivated occasionally.

In the Nighantas the plant is described as purgative, pungent, digestive, bitter and heavy, and is said to be useful in constipation, flatulent distention, tumours, swellings, abdominal enlargements, rheumatism, spleen, leprosy, mania and jaundice.

A plaster, prepared from the roots and mixed with asafœtida, is applied externally to the stomachs of children suffering from worms. The bark of the root is purgative, and the stem is given in decoction in gout.

The juice, which flows from the branches, is used as a purgative to relieve pain in the loins. It is an acrid irritant in rheumatism and tooth-ache. When taken internally, it acts as a drastic purgative. It is also employed in nervine diseases, dropsy, palsy, deafness and amaurosis. It is a popular application to warts and other cutaneous affections.

The juice is prescribed as a purge and deobstruent in those visceral obstructions and dropsical affections which are consequent on long-continued intermittent fever. Externally, mixed with margosa oil, it is applied to limbs which have become contracted from rheumatism.

In Bombay the root is mixed with country liquor to make it more intoxicating, and the juice is used to kill maggots in wounds, and is dropped into the ear to cure earache, a practice common to many parts of India. In the Konkan the stem is roasted in ashes, and the expressed juice, with honey and borax, given in small doses to promote the expectoration of phlegm.

The Mundas of Chota Nagpur use the milky juice to poison and catch fish. The juice is also used as a purge: mixed in a raw egg it gives as many stools as there are drops of the juice in the mixture.

A preparation from this plant is given as a cure for cough by the Santals.

The hard woody part of the stem is used medicinally by the Malays.

In Cambodia the latex is used as an emetic; the core of the plant is administered in dysentery and in febrile conditions. Throughout Indo-China the milky juice is reputed emetic, purgative, and hydragogue.

The Hindus employ the root mixed with black pepper as a medicine for the cure of snake-bites internally and externally. Mhaskar and Caius have experimented with both the root and the milky juice, and they have found that, whether given internally or applied externally, those drugs are useless in the treatment of snake-bite.

Annam : Xuong rong— ; *Arabic* : Zaqqum-e-hindi— ; *Belgaum* : Tindarisend— ; *Bengal* : Bajvaran, Lariyadaona, Nagri, Narasij, Tekatasij— ; *Burma* : Pyathal, Shasoung-pyathal, Shazanoji, Tazaung— ; *Cambodia* : Chanlat day— ; *Bombay* : Bontakalli, Bontegalli, Bontekalli, Chaturagalli, Jadekalli, Mundugalli— ; *Ceylon* : Chaturakkalli— ; *Deccan* : Tidharisend, Tindharisend— ; *English* : Spurge Cactus— ; *Gujerati* : Tandharisend— ; *Hasada* : Siddaru— ; *Hindi* : Narashij, Sayord, Tidharasend— ; *Indo-China* : Chan leat day, Thanh long, Xuong rong— ; *Malayalam* : Chaturakalli, Kalli, Ratakkali— ; *Marathi* : Naraseja, Narsej— ; *Michi* : Shidu— ; *Mundari* : Eteke, Etete, Siddaru, Marangeteke— ; *Persian* : Zaqqum-e-hindi, Zaqunniya-e-hindi— ; *Sadani* : Sid— ; *Sanskrit* : Sihunda, Simhunda, Snuhi, Tridharaka, Vajra, Vajrakantaka, Vajri— ; *Santal* : Etke, Etkec'— ; *Sinhalese* : Daluk— ; *Tamil* : Amudangam, Kalli, Kandiravam, Kaniravam, Kodiravam, Mavirukkam, Murittargalli, Sadurakkalli, Saduchi, Sunakkudam, Tiruvargalli, Vachiram, Vachirangam, Valangalli— ; *Telugu* : Bommajemudu, Bontajemudu, Bontakalli, Peddajemudu, Simhundumu— ; *Tulu* : Darekhalli— ; *Urdu* : Zakum— ; *Uriya* : Dokahanasiju, Dokanasij, Lohasiju— ; *Yemen* : Gholak, Kelah—.

2. **Euphorbia Atoto** Forst. is found on the Malabar Coast, from Canara southwards. It is common on the sandy seashores of the Malay Peninsula, the Andaman Islands, and Ceylon. It is distributed to the Malay Archipelago, China, Australia, and the Pacific Islands.

In Indo-China women use the milky juice as an emmenagogue, and also as an abortifacient. According to Sallet, when prepared in a certain way and cooked with honey over the water bath the latex is a good remedy for tuberculosis.

In New Caledonia sea-water in which the plant has been soaked and malaxated is very much used as a purgative.

Indo-China : Thuoc doi—.

3. **Euphorbia dracunculoides** Lam. is met with throughout India in the plains and low hills. It extends westwards to Arabia and tropical Africa.

The fruit is used to remove warts.

Bengal : Chhagulpuputi, Jychee— ; *Hindi* : Chagulputputi— ; *Punjab* : Kangi, Richni, Sudab— ; *Rajputana* : Bamburi— ; *Santal* : Parwa— ; *Telugu* : Tillakada—.

4. **Euphorbia granulata** Forsk. inhabits the Western Peninsula, Chota Nagpur, Malwa, the Rajputana Desert, the Punjab, Sind, Afghanistan, Arabia, Egypt, and the Canary Islands.

In Las Bela the plant is said to purify the blood.

Arabic: Lebbaejde, Lebbejn, Libbein, Melachene—; *Jhalawan*: Gwandar—; *Kharan*: Shirgonah—; *Las Bela*: Khirwal—; *Rajputana*: Dudeli—; *Santali*: Kantha arak—.

5. **Euphorbia helioscopia** Linn. is a common field-weed in spring throughout the Punjab plains and the Siwalik tract, ascending to 7,000 feet in the outer Himalaya. It has been introduced into the Nilghiris. It spreads over Afghanistan, and westwards to the Atlantic. It also occurs in Japan.

The plant is used as a hydragogue cathartic, and the juice is applied to remove warts. The juice is sometimes, though improperly, used to cure sore eyelids, causing in many instances intolerable pain and inflammation.

In the Punjab the milky juice is applied to eruptions, and the seeds are given with roasted pepper in cholera. In Waziristan the juice is used in herpes.

In Sind the juice is used in the form of a liniment in neuralgia and rheumatism, and the root is employed as an anthelmintic.

The latex is successfully used for the removal of warts in South Africa.

Afrikaans: Melkbos, Melkgras, Wolfsemelk—; *Arabic*: Rumude, Ssaade—; *Baluchistan*: Gurbagund, Sohrbulok, Zahrihk—; *Catalan*: Lletera, Lleterola, Mal d'ulls—; *Chinese*: Tse Ch'i—; *English*: Cat's milk, Churn-staff, Sun Spurge, Wartwort—; *French*: Lait de couleuvre, Omblette, Réveille matin, Tithymale—; *Hindi*: Hirruseeth, Mahabi—; *Iraq*: Khannaq-ad-dijaj, Um-al-halib—; *Italian*: Esula, Titimaglio, Titimalo, Tutumaglio—; *Kharan*: Gurbagund—; *Malta*: Cat's Milk, Spurge, Sun Spurge, Erba calenzuola, Tenghoud—; *Punjab*: Chatriwal, Dudal, Gandabute, Kulfadodakak—; *South Africa*: Milkweed, Spurge—; *Spanish*: Lechetrezna, Mirasol—; *Waziri*: Sagergotiae—.

6. **Euphorbia hirta** Linn. (= *E. pilulifera* Linn.) is a common weed in waste ground, found throughout the hotter parts of India from the Punjab eastwards, and southwards to Ceylon and Singapore. It inhabits most of the tropical and subtropical countries.

The dried herb is stimulant, expectorant, and diuretic. It has been frequently reported useful for bronchitis and asthma affections.

The juice of the plant is given in dysentery and colic, and the milk applied to destroy warts. A decoction is used in asthma and chronic bronchial affections.

The plant is chiefly used in the affections of childhood, in worms, bowel complaints, and cough. It is sometimes prescribed in gonorrhœa.

The root is given by the Santals to allay vomiting, and the plant to nursing mothers when the supply of milk is deficient or fails.

The plant is widely used in West Africa as a medicine. In Gold Coast it is ground and mixed with water for use as an enema for constipation. The white juice is used by women to increase the flow of milk. The leaves are used in curing sores; their juice is sometimes squeezed into the eyes to cure eye trouble.

Similarly in Liberia the plant is given along with lime juice as a laxative, and the latex is applied for conjunctivitis; a thorn or other foreign body is extracted with the help of the latex, which is also applied locally as an antidote to arrow poison or to assist extraction of the head.

The herb is very much used in La Reunion as an astringent in chronic diarrhœas and dysenteries. It is also applied topically to ulcers, oedemas, and phlegmons. The juice is given for aphthae. It is considered tonic, narcotic, and antiasthmatic.

A popular astringent and haemostatic in the Philippine Islands. It is used in the treatment of dysenteries in Annam.

The plant is much used in Guiana as a febrifuge. As a poultice it is applied to abscesses and inflamed glands.

The plant is known in Australia as 'Queensland asthma herb'. It is used there as a remedy for coughs, bronchial and pulmonary disorders, but more especially in paroxysmal asthma.

There is no doubt that an extract of this plant has a sedative effect on the mucous membrane of the respiratory and genito-urinary tract. It has been found by me very beneficial in cases of asthma. I have been using a tincture of it in my private practice in diseases of the genito-urinary tract and in chronic bronchitis and asthma. The result has been very satisfactory (Koman).

According to Dikshit and Kameshwar Rao experiments conducted on cats, dogs, and rabbits, with and without anaesthesia, show that the drug has got a fairly marked action on the respiratory system, depressing the respiration and producing a well marked dilatation of the bronchioles. The drug produces a local irritation of the stomach when given by mouth in larger doses and produces nausea and vomiting. If injected intravenously in animals, however, it has got a depressant action on the movements of the intestines. There is an immediate cessation of the automatic movements of the intestines and a relaxation of the tone of the muscle. The cardiovascular system is depressed, and an intravenous injection leads to a fall of blood pressure chiefly due to the depression of the heart. Perfusion experiments show a depression of the heart. Other systems of the body like the genito-urinary system are not markedly affected (18th Ind. Sc. Congress; Nagpur, 1931).

Australia : Queensland Asthma Herb—; *Awuna* : Ahinkodze, Notsigbeng—; *Bengal* : Barakerui, Burakeru, Burokeruee—; *Betsileo* : Aidinono—; *Bombay* : Nayeti—; *Canarese* : Achchegida—; *Central Provinces* : Gordon—; *Ceylon* : Madduppachcharichippillu, Palavi—; *English* : Asthma Herb, Asthma-weed, Australian Asthma Herb, Euphorbia, Pill-bearing Spurge, Snake Weed—; *Ewe* : Notsigbee—; *Fiji* : Do ni osi—; *French* : Euphorbe à globules, Euphorbe à pilules, Herbe à Jean Renaud, Herbe Jean Robert, Herbe à serpents, Madelone plat, Mal famée, Malnommée, Pilulier, Poil de chat—; *French Guiana* : Grande malnommée, Petite malnommée rouge, Malnommée—; *Guam* : Golondrina—; *Gujerati* : Dudeli, Dudh, Nagladudheli, Ratidudheli—; *Hausa* : Nonankurchiya—; *Hindi* : Bahidudhi, Dudhi, Laldudhi—; *Indo-China* : Co sua lon la, Ka ta, Phi duong thao, Vu sua—; *Kolami* : Pusitoa—; *Konkani* : Dudurly—; *Kwang Tung* : Yu Tchou Ts'ao—; *La Reunion* : Jean Robert—; *Lepcha* : Sung-gryong muk—; *Malay* : Ambin jantan, Gelang susu, Kurumak susu—; *Malayalam* : Nelapalai—; *Mano* : To a gbondo—; *Marathi* : Dudhi, Dudnali, Govardhan, Mothidudhi, Nayati—; *Mauritius* : Jean Robert—; *Mundari* : Kodasing—; *Nzima* : Akubaa—; *Oloke Meji* : Emi-ile, Emile—; *Pampangan* : Bolobotones, Magatas, Malismhalis, Sisiohan, Sisiwhan—; *Philippines*: Batabotonis, Botobotones, Golandrina—; *Porebunder*: Mothidudheli, Motodakardumaro, Ratodakardumaro—; *Sanskrit*: Nagarjuni, Pusitoa—; *Sinhalese*: Budadakiriya, Dadakiriya, Kiritala—; *Susu*: Boxeforotai, Nyalefoxe, Nyayafoke—; *Tagalog*: Batobatonis, Gatasgatas, Sayican—; *Tamil*: Amumpatchaiyarissi, Patchaiyarissi—; *Telugu*: Bidarie, Nanabala, Nanabiyan, Reddinanabrolu—; *Timne*: Ebit, Yankara-ebit—; *Twi*: Ahinkodge—; *Visayan*: Bovi, Buyayava, Gatasgatas, Tavava—; *Wolof*: Homguelem—; *Yoruba*: Egele, Ege-ile, Emi-ile—.

7. **Euphorbia hypericifolia** Linn. is common throughout the hotter parts of India and Ceylon, and occurs up to 4,000 feet on the Himalaya. It is found in the tropics generally, with the exception of Australia and Pacific Islands.

An infusion of the dried leaves is a remedy in dysentery, diarrhœa, menorrhagia, and leucorrhoea, and it affects the system as an astringent and feeble narcotic.

It is given with milk to children in colic.

In Guiana cataplasms of the plant are applied in cephalalgia. In La Reunion the plant is considered drastic, but rarely used as such; it is better known as an astringent and styptic.

In Annam a decoction of the plant is used in measles and in gravel.

Arabic: Melachene—; *Bombay*: Nayeti—; *Brazil*: Erva de Santa Luzia—; *French Guiana*: Marie claire—; *Gujerati*: Dudheli—; *Hindi*: Dudhi, Dudhikalava, Hakshardana—; *Indo-China*: Chanleat, Co sua, Vu sua—; *La Reunion*: Herbe Saint-Jean, Jean Belan—; *Marathi*: Dhaktidudhi, Dudhi, Dudhmogra—; *Mauritius*: Herbe colique, Herbe mal lévé—; *Porebunder*: Dhakradunmaro, Dudheli—; *Punjab*: Hazardana—; *Rajputana*: Dudeli—; *Sanskrit*: Dugdhika—; *Sinhalese*: Eladadakiriya—.

8. **Euphorbia longifolia** D. Don has been reported from Thoucote in Nepal. It is also reported that the juice is applied to fistulous sores in Kashmir and the Punjab.

9. **Euphorbia microphylla** Heyne is found in Bengal, Bundelkhand, Southern India, Burma and Java.

In Chota Nagpur, a preparation of this plant, along with that of *Cryptolepis Buchanani* is given to nursing mothers when the supply of milk fails or is deficient.

Bengal: Chotokeruee—; *Gujerati*: Dudhi—; *Marathi*: Dudhi—; *Porebunder*: Ekphulidudheli—; *Santali*: Dudhiaphul—.

10. **Euphorbia neriifolia** Linn. is common in rocky places throughout the Western Peninsula. It is cultivated elsewhere in India, as also in Ceylon, Burma, Baluchistan and the Malay Islands.

The plant is a reputed Ayurveda medicine. The Nighantas describe it as 'bitter, pungent; laxative, carminative, alexipharmic; improves the appetite; useful in abdominal troubles, bronchitis, tumours, loss of consciousness, delirium, leucoderma, piles, inflammations, enlargement of the spleen, anaemia, ulcers, fevers.—The milk is pungent, laxative; good for abdominal troubles, tumours, leucoderma.—The leaves are heating, carminative; improve the appetite; good for tumours, pains, inflammations, abdominal swellings.

The Yunanists consider it a good substitute for *E. Tirucalli.*

The milky juice is used as a purgative and a rubefacient. It is prescribed as a cathartic and deobstruent in visceral obstructions and dropsical affections consequent on long continued fever. It enters into the composition of most of the drastic purgatives.

The juice is empolyed in earache; mixed with shoot it is applied to the eye in ophthalmia; mixed with margosa oil it is used as an application in rheumatic affections.

On the Western coast the bark of the root, boiled in rice water with the addition of arrack, is considered useful in dropsy.

In the Rajputana Desert the milky juice is used as a cure for coughs, and is applied to the skin as a blister.

The leaves are used as a diuretic in Indo-China.

The juice of the leaves is a popular cure for earache in the Philippine Islands.

A succus consisting of equal parts of the juice of this plant and simple syrup was prepared and administered in doses of 10 to 20 minims three times a day in cases of asthma, and was found to give relief to the fits of that disease (Koman).

The milk and the root enjoy an almost universal repute as remedies in snake-bite. Mhaskar and Caius have, however, found the two drugs useless in the antidotal and symptomatic treatment of snake-bite and scorpion-sting, and equally useless when applied topically to the bite or the sting.

Annam: Xuong rong rao—; *Arabic*: Wurzizuker—; *Bengal*: Hijdaona, Mansasij, Patashij, Shij—; *Berar*: Thuar, Thuhar—; *Bombay*: Minguta, Newarang, Thor—; *Burma*: Shasaung, Shasoung, Shazawnminna, Zizaung—; *Canarese*: Elegalli, Yalekalli—; *Deccan*: Kuttekijibhkapatta, Kuttekijibhkasend. Newrung, Putteunkesaynd, Thoor—; *Goa*: Nevulkanta—; *Gujerati*: Thor, Tuaria—; *Hindi*: Munsasej, Pattonkisend, Putteun, Sehund, Senhur, Sij, Thohar, Thor—; *Ilocano*: Carambuaya—; *Indo-China*: Giang lam, Xuong rong, Xuong rong rao, Xuong rong ta—; *Kolami*: Etke—; *Konkani*: Nivalkantem, Nivalkanti—; *Malay*: Sesudu—; *Malayalam*: Ilakalli, Kalli—; *Marathi*: Mingut, Nevagunda, Newrang, Niwarung—; *Nimar*: Thuar, Thuhar—; *Pampangan*: Bait, Sorogsorog, Sorosoro—; *Philippines*: Lengua de perro—; *Portuguese*: Cardeira—; *Punjab*: Gangichu—; *Rajputana*: Thor—; *Sanskrit*: Patrasnuhi, Pattakari, Snuhi, Svarasana—; *Santali*: Etke—; *Sind*: Minaguta, Nivadunga, Thohur, Thoor—; *Sinhalese*: Paluk, Patuk—; *Tagalog*: Bait, Sorogsorog, Sorosoro—; *Tamil*: Ilaikkalli, Kalli, Manjevi, Nadangi, Naynakki—; *Telugu*: Akujemudu—; *Tulu*: Irekalli—; *Urdu*: Zakum—; *Uriya*: Siju—.

11. **Euphorbia nivulia** Ham. is found in dry rocky places throughout Bengal, South India, and Bengal. It is often planted for hedges.

The Yunanists use the plant as a substitute for *E. Tirucalli.*

The juice of the leaves is used internally as a purgative and a diuretic; mixed with nim oil it is applied externally in rheumatism. The warm juice is a good cure for earache, and it is occasionally rubbed over the eyes to remove dimness of sight.

On the Western Coast the root bark is boiled in rice water and arrack, and given in dropsy.

The pulp of the stem, mixed with green ginger, is given to persons bitten by mad dogs.

Bengal: Sij—; *Berar*: Thuar, Thuhar—; *Burma*: Shasoung—; *Canarese*: Dubbakalli, Dundukalli, Gutagalli, Yellakalli—; *Deccan*: Patteoon—; *Dehra Dun*: Thor, Thuor—; *Gujerati*: Thorkantalo—; *Hasada*: Eteke—; *Hindi*:

Katathohar, Senhur, Sij, Thor, Thuhar, Thura—; *Jaunsar*: Suru—; *Kolami*: Etke, Etki—; *Lambadi*: Motataria—; *Malayalam*: Ilakalli—; *Marathi*: Kaudenivdung, Newrang, Nivdung, Niwarung—; *Mundari*: Burueteke—; *Nimar*: Thuar, Thuhar—; *Porebunder*: Kautalio, Thorkantalo—; *Rajputana*: Raj, Tor—; *Sanskrit*: Patrasnuhi, Sehuda, Svarasana, Vajradruksha, Vajri—; *Santali*: Etke—; *Tamil*: Ilakalli, Manjevi, Nanangalli—; *Telugu*: Akujemudu, Akukalli, Bonthajamudu—; *Urdu*: Zakum—; *Uriya*: Kolosiju, Siju—.

12. **Euphorbia rosea** Retz is found in the Deccan Peninsula, from the Carnatic to Tranquebar, on the coast. It is common near the sea in Ceylon and Indo-China. It also occurs in Afghanistan.

The plant is used as a drastic purgative in Indo-China. The leaves and seeds are considered to be a good worm remedy.

Indo-China: Co sua, Nohn la—.

13. **Euphorbia Royleana** Boiss. is common on dry rocky hillsides of the outer Himalaya from the Indus to Kumaon, ascending to 6,000 feet. It occurs also on the Salt Range.

The acrid milky juice possesses cathartic and anthelmintic properties.

Beas: Chu, Chunga, Surs—; *Chenab*: Chula—; *Dehra Dun*: Thor, Thuor—; *Garhwal*: Surai—; *Hindi*: Senhur, Shakarpitan, Thar, Thor—; *Jaunsar*: Suru—; *Jhelum*: Suli—; *Kumaon*: Sihund, Sohund—; *Punjab*: Shakarpitan, Thar, Thor—; *Rajputana*: Thor—; *Ravi*: Chun—; *Salt Range*: Tordanda—; *Sutlej*: Suro, Tsui—.

14. **Euphorbia sanguinea** Hochst. occurs in Baluchistan, spreading over to Afghanistan, tropical Arabia and Africa.

When used for medicinal purposes it is prepared like 'bhang' (Hotson).

The Sutos use it as an application to sore nipples in suckling mothers.

Brahui: Meshir—; *Pretoria*: Spurge—; *Suto*: Kxamamaswana, Selwe, Tatampoi-e-nyenyane—.

15. **Euphorbia Thomsoniana** Boiss. is found in Kashmir between 10,000 and 12,000 feet.

The crushed root-stocks are employed by the natives of Kuram as detergents for washing the hair, and, when boiled, are given as purgatives.

Kashmir: Hirtiz—.

16. **Euphorbia thymifolia** Linn. is common in paths and gravelly spots in the plains and lower hills of India, Ceylon, and the Malay Peninsula; ascending up 5,500 feet in Kashmir. It is found in all hot countries except Australia.

The dried leaves and seeds are slightly aromatic and astringent. They are given in worm cases and in certain bowel affections of children in the Tamil country. In Northern India they are considered stimulant and laxative. They are commonly used as a purgative in Sind.

The Santals use the root as a remedy for amenorrhœa.

In the Konkan the juice is used to cure ringworm. Among the Mundas of Chota Nagpur it is employed to stop diarrhœa; half a handful of the whole plant being pounded and drunk in a mixture with water and sugar-candy.

In Indo-China the plant is used as a cathartic; the seeds and leaves are considered anthelmintic.

In Arabia the juice of the plant is made into a paste with wheat flour, and administered as a purgative in the form of pills. The bruised plant is applied to wounds.

In La Reunion the herb is used as an astringent in diarrhœa and dysentery.

The expressed juice or the powdered plant is administered internally with wine as a remedy for snake-bite, and it is applied externally to the part bitten; but whether given internally or applied externally the plant is equally useless in the treatment of snake-bite (Mhaskar and Caius).

Arabic: Rummid—; *Bengal*: Dudiya, Shweetkeruee, Swetkerua, Swetkirui—; *Bombay*: Nayata, Nayeti—; *Ceylon*: Ammanpachcharichippillu, Chittirapalavi—; *Gujerati*: Nahanidudheli—; *Hindi*: Chhotidudhi, Chothaduhi—; *Indo-China*: Co sua, Nhon la—; *La Reunion*: Rougette—; *Malay*: Segan padang—; *Marathi*: Ghakdidudhi, Lahandudhi, Mothidudhi—; *Mauritius*: Petite rougette—; *Mundari*: Kdoasingjaite—; *Nasirabad*: Khiri—; *Persian*: Gazardanah—; *Porebunder*: Jhinkidudheli, Jhinkodhakardhumaro—; *Punjab*: Baradodak, Dhoduk, Hazardana—; *Sanskrit*: Laghudugdhika, Raktavindachada—; *Santali*: Nanhapusitoa, Nanhapusituar—; *Sind*: Dhoduk, Hazardhana—; *Sinhalese*: Bindadakuriya—; *Tamil*: Chinamampatchaiyarisi, Sittrapaiadi—; *Telugu*: Bidurunadabiyam, Reddivarimanubala—; *Yemen*: Rummid—.

17. **Euphorbia Tirucalli** Linn., a native of Africa, has become naturalised in the drier parts of Bengal, the Deccan, South India, and Ceylon; elsewhere it is largely cultivated for hedges, and in Berar is much grown to shelter young mango plants from direct sunlight.

According to Yunani practitioners the juice of this plant is purgative, carminative; useful in gonorrhœa, whooping cough, asthma, dropsy, leprosy, enlargement of the spleen, dyspepsia, jaundice, colic, tumours, stone in the bladder.

The fresh milky juice is applied to warts and used as a rubefacient embrocation in rheumatism. It is good alterative in syphilis, and a good application in neuralgia. In the Konkan it is given as a purge; and the charcoal, which is very light, is used in making pastilles. In Goa it is used to poison fish. The milky juice is a dangerous drug to handle, causing severe and tenacious conjunctivitis.

In Cambodia the plant is used to stupefy fish.

The root is used in La Reunion as a vesicant, more rarely as an emeto-cathartic.

The bark is used as a vesicant in Java, and is also applied to fractures.

In some parts of India a decoction of the root is given in certain cases of colic, and the milky juice mixed with melted butter is prescribed as a purge. The juice is also applied topically in neuralgia.

In Malaya the latex is inserted into cuts in bullocks to form the elevated recognition marks.

Annam: Cay san ho, San ho—; *Arabic*: Azfur-zukkum, Zaqqum-e-hindi—; *Baluchi*: Dedar—; *Bengal*: Gul, Lankasij, Latadaona—; *Bombay*: Niwal, Sehund, Seyr, Shera, Tej, Thor, Thora—; *Burma*: Shashoungleknyo, Shasoungleknyo, Tazaunglekhnyo—; *Canarese*: Bontakalli, Bottugalli, Kadunevali, Kalli, Kodukalli, Kolugalli, Kolukalli, Nandugalli, Pachanegalli, Yellegulla—; *Cochin-China*: Cay san ho xanh—; *Deccan*: Barkisend, Karikisend, Send—; *English*: Milk Bush, Milk Hedge, Indian Tree Spurge—; *Goa*: Nival—; *Gujerati*: Dandalithora, Pardeshithora, Thordandalio—; *Hindi*: Konpahlsehnd, Sair, Sehud, Sehund, Sendh, Shirthohar, Sij—; *Indo-China*: Ramok, San ho xanh, Thanh san ho, Thap nhi, Xuong kho—; *Java*: Kayoo-oorb—; *Lambadi*: Taria—; *La Reunion*: Laine sans feuilles, Tirucalli—; *Malayalam*: Guda, Katerumakkali, Kolkalli, Tirukalli—; *Marathi*: Nevli, Nirval, Nivla, Niwarung, Seyr, Seyrteg, Shar, Shera, Tej, Thuvar, Vajraduhu—; *Mauritius*: Calli—; *Melghat*: Thuar, Thuhar—; *Nimar*: Thuar, Thuhar—; *Persian*: Shirtothar, Zaquniya-e-hindi—; *Porebunder*: Kharsanithora, Thora—; *Sanskrit*: Bahukshira, Dandasruha, Ganderi, Snuka, Trikuntaka, Vajradruma—; *Santali*: Siju—; *Sind*: Sair, Sij, Thora—; *Sinhalese*: Navahandi, Thovar—; *Tagalog*: Catuit—; *Tamil*: Kalli, Kiri, Kombukkalli, Pachankalli, Parchanu, Tirukkalli, Tiruvatti—; *Telugu*: Chemudu, Jemudu, Kadujemudu, Kalli, Kanjiemudu, Sannajemudu, Tirukalli—; *Tigrinia*: Qoutscheh—; *Tulu*: Kodukalli—; *Urdu*: Zakum—; *Uriya*: Lonkasiju—; *Yemen*: Dahan, Rummid—; *Zulu*: uMunde, umIululu—.

18. **Euphorbia trigona** Haworth inhabits dry rocky hills in the Deccan, and probably other parts of India. It is found in the Andaman Islands and the Moluccas.

The fresh milky juice is a direct irritant both when taken internally and applied externally. Taken in very small quantities, it is a drastic purgative.

Telugu: Kattimandu—.

19. **Euphorbia turcomanica** Boiss. is found in Baluchistan, whence it extends to Persia and Mesopotamia.

In Baluchistan the plant is boiled and used as a medicine for gripe.

Brahui: Meshir—.

EXCOECARIA.

The genus consists of 30 species, inhabiting the tropics of the Old World.

A deciduous shrub	1. *E. acerifolia.*
A small evergreen tree	2. *E. agallocha.*

1. **Excoecaria acerifolia** Fr. Didrichs. is found at 5,000-6,000 feet in the western and central Himalayas from Nepal to Kumaon. It also occurs in the Khasia Hills.

The Bhutias of East Kumaon use the leaves as a remedy for rheumatism.

Garhwal: Dudhila—; *Kumaon*: Basingh—.

2. **Excoecaria agallocha** Linn. is a common small evergreen tree of the Coast and tidal forests of India, Burma, the Malay Peninsula, the Andaman Islands, the Malay Archipelago, North Australia, New Caledonia to Tonga.

The milky juice, which exudes from the bark of this tree when green and fresh, is very acrid and injurious to the eyes, hence it is called 'the blinding tree of India'.

A decoction of the leaves is occasionally given by Hindu doctors in epilepsy, in the quantity of a quarter of a tea-cupful twice daily. This decoction is also used as an application to ulcers.

From the lower part of the trunk and roots, a soft, light, reddish suber is obtained, which is sold by the itinerant medicine men of Western India, under the name of *Tejbul,* as an aphrodisiacal tonic.

The natives of Eastern Australia, as well as those of New Guinea, use the milky juice to cure certain ulcerous chronic diseases, e.g., leprosy.

In Fiji, it is employed for the cure of leprosy, its mode of application being very singular. The body of the patient is first rubbed with green leaves; he is then placed in a small room and bound hand and foot, when a small fire is made of pieces of the wood of this tree from which rises a thick smoke; the patient is suspended over this fire, and remains for some hours in the midst of the poisonous smoke and under the most agonizing torture, often fainting. When thoroughly smoked, he is removed, and the slime is scraped from his body; he is then scarified and left to await the result. In some cases he is cured, but frequently the patient dies under the ordeal.

The milky latex obtained from the bark when it is green is used by Malays as an irritant poison; it is so acrid when fresh that it blisters the skin. In Kelantan it is given internally as a poison.

Andamans : Yekin—; *Australia* : Blind-your-eyes, River Poisonous Tree—; *Bengal* : Gangwa, Gengwa, Geogheria, Geor, Geria, Goria, Uguru—; *Bombay* : Geva—; *Burma* : Kayau, Kayaw, Tayau, Tayaw—; *Canarese* : Hara, Haro—; *English* : Blinding Tree, Milky Mangrove—; *Fiji* : Sinu-gaga—; *Formosa* : Hsiang shu—; *Hindi* : Gewa—; *Igorrote* : Ali—; *Indo-China* : Gia, Ngai, Soen gia, Tia mu, Va, Ya—; *Malay* : Aquila, Baboeta, Babooter, Bebuta, Bubuta, Butabuta, Garamataboeta, Noto—; *Malayalam* : Katappala, Karmmatti, Komatti—; *Marathi* : Geva, Phungali, Suran, Surind, Surund—; *Marinduque* : Diladila—; *Pampangan* : Butabuta, Himbabao—; *Queensland* : Balavola karping—; *Samoa* : Toto—; *Sanskrit* : Agaru, Uguru—; *Sinhalese* : Talakiriya, Telakiriya, Tellakwiya—; *Spanish* : Arbol del ciego, Buta de Filipinas—; *Tagalog* : Botabota, Buta, Butabuta—; *Tamil* : Agadil, Agi, Ambalatti, Ambalavirukkam, Tillai, Perundillai—; *Telugu* : Chilla, Tella, Tilla—; *Uriya* : Ghona, Gowan—; *Visayan* : Alipata, Himbabao, Lipata, Siac—.

FLUEGGEA.

The genus consists of 6 species, found in the tropics of the Old World.

Branchlets stout ending in spines	1. *F. leucopyrus.*
Branchlets slender unarmed	2. *F. virosa.*

1. **Flueggea leucopyrus** Willd. occurs in Sind, the Punjab Plain, Burma, the Western Peninsula from Canara southwards. It is abundant in Ceylon.

The juice of the leaves, or the leaves made into a paste with tobacco, are used to destroy worms in sores.

The plant is said to be a fish poison.

Afghanistan: Perapastawane—; *Canarese*: Bilchuli, Gudahale, Huli—; *Central Provinces*: Challamanta, Salemanta—; *Goa*: Parpo—; *Gujerati*: Shinavi—; *Hindi*: Suffaidmahommad—; *Malayalam*: Perinklavu—; *Marathi*: Kandekuvana, Pandharphali—; *Matheran*: Pandharphali—; *Merwara*: Halepan, Salipan—; *Nepal*: Achal—; *North-Western Provinces*: Aintha, Hartho—; *Porebunder*: Tumari—; *Punjab*: Bata, Bhathi, Gargas, Girk, Girthan, Kakun, Vanuthi—; *Rajputana*: Halepan, Salepan—; *Sanskrit*: Apiyadruma, Bhuriphali, Panduphali, Svetakamboja—; *Sind*: Kiran—; *Sinhalese*: Hinkatupila—; *Tamil*: Irubulai, Mudbulanji, Mulluppulatti, Pula, Pulanji, Varadbul, Varadbula, Vedbula, Vellaippula, Vellaippulanji—; *Telugu*: Challamunta, Mekarayi, Puli, Tellapulisaru, Tellapuliyudu, Tellapurugudu—.

2. **Flueggea virosa** Baill. (=*F. microcarpa* Bl.) occurs throughout India, Ceylon, and the Malay Peninsula. It extends to the Malay Islands, China, Australia, and tropical Africa.

The juice of the leaves, or the leaves made into a paste with tobacco, are used to destroy worms in sores.

The West Ashantis use the roots to cure gonorrhœa. They boil the whole plant in water and wash themselves in the water to 'become strong'.

In Rhodesia the root is used as an aphrodisiac.

The Ewe people of Togoland use the leaves to cure constipation. For this purpose they are boiled and the water is drunk.

In Indo-China the astringent bark is used to stupefy fish.

Arabic: Dabalab, Hamrur, Hemmele, Hennet-el-bagar, Kartjikartji—; *Ashanti*: Nkangnaa—; *Bedde*: Zandanu—; *Bombay*: Kantepuwan, Pandharphali—; *Buldana*: Pittor—; *Burma*: Konchiny a—; *Canarese*: Belahuli, Bilisuli, Gudahale—; *Chindao*: Umsosoti—; *Dagomba*: Susuwuluga—; *Dehra Dun*: Rithoul—; *Ewe*: Esre, Hesre, Hlese—; *Fulani*: Chamal, Chambe, Chame—; *Ga*: Gbekebii able-tcho—; *Goa*: Papo—; *Gujerati*: Shaunavi—; *Hausa*: Gussu, Gwiwar kare, Tsa, Tsugawun kare, Tswa—; *Hindi*: Dalme, Patala—; *Indo-China*: Bong ne, Bong no, Cang pa, Mai ten, Nhat giep thu, Xeur nam—; *Kumaon*: Athaina—; *Kanuri*: Shimshim—; *Lambadi*: Jarigaro—; *Lepcha*: Hik-ti bi—; *Malayalam*: Perinklavu—; *Marathi*: Kodarai—; *Melghat*: Pithondi—; *Merwara*: Halepan, Salipan—; *Nimar*: Jhonri—; *Sanskrit*: Apiyadruma, Bhuriphala, Dhusara, Nilishila, Panduphali, Patali, Vrittabijaka—; *Saora*: Jungjang—; *Sierra Leone*: Tigwi—; *Sokoto*: Tsa, Tswa—; *Tamil*: Irubulai, Pula, Varadbula, Vedbula, Vellaippula—; *Telugu*: Mekarayi, Sulamunta, Tellapuli, Tellapurugudu—; *Uriya*: Janjingi, Kanilehya—; *Yoruba*: Iranje—.

GELONIUM.

The genus includes 20 Asiatic and African species.

Gelonium multiflorum A. Juss. occurs in Bengal and the Circars, reaching northwards to the foot of the Sikkim Himalaya. It extends from Chittagong to Tenasserim and Malacca, and is found in the woods of Upper and Lower Burma, and the Malay Peninsula. It is distributed over the Malay Islands, Siam, and China.

The bark is considered a good tonic for the gums, and is prescribed for gingivitis in Cambodia; it is also used as a purgative in hepatic troubles.

Burma: Setahanbaya—; *Cambodia*: Tromung sek—; *Hindi*: Ban naringa—; *Malay*: Buah punei, Lampun hitam, Mingantok, Ruas-ruas—; *Telugu*: Sarugata—.

Glochidion.

The genus includes 160 species spread over tropical Asia and Polynesia.

G. rubrum Bl. is used medicinally in Indo-China.

Leaves 2-4 in. thin. Anthers 3 ... ... 1. *G. hohenackeri.*
Leaves 4-8 in. coriaceous. Anthers 5-6 ... ... 2. *G. zeylanicum.*

1. **Glochidion hohenackeri** Bedd. is found in Chota Nagpur and Orissa, and in the Western Peninsula; it is very common in the Konkan.

The bark is given medicinally when the stomach revolts against food.

Canarese: Banavara, Nirchalli, Nirchelli, Nirjani, Sullai—; *Malayalam*: Kuluchan—; *Marathi*: Bhoma—; *Uriya*: Baniakandhum, Chikni, Kalchia—.

2. **Glochidion zeylanicum** A. Juss. occurs in the Western Peninsula.

The bark is used as a stomachic.

Canarese: Banda, Savregidda—; *Malayalam*: Nirvetti—; *Tamil*: Kumbalam—; *Telugu*: Itepulla—.

Hippomane.

H. mancinella Linn. is a native of tropical America, introduced into Indian gardens.

The bark and the berries yield a highly poisonous milky acrid juice. It is a violent irritant and powerful cathartic, diuretic, and vesicant. The least drop applied to the eye will cause blindness for some days; the smoke from the wood when burnt will also seriously affect the eyes.

The juice is much used in Cuba for tetanus and in Guiana for worms in children. Indians use it to poison their arrows.

Cayenne: Figuier—; *Cuba*: Manzanillo—; *English*: Manchineal Tree—; *French*: Arbre de mort, Arbre poison, Bois de lait, Figuier vénéneux, Mancenillier, Noyer vénéneux—; *German*: Manzenillerbaum—.

Homonoia.

The genus consists of 4 Indo-Malayan species.

Homonoia riparia Lour. is a small rigid evergreen shrub, found on the rocky and stony river-beds of the Sikkim Himalaya at an altitude of 1,000 to 2,000 feet; also in Assam, the Khasia Hills, and southwards to Burma, Tenasserim, the Malay Peninsula, the Andaman Islands, and Bundelkhund; and in the Deccan Peninsula from the Konkan southwards. It is also common in Ceylon up to an elevation of 2,000 feet. It extends to Siam, Cochinchina, Sumatra, Java, and the Philippine Islands.

The root is given for ulcers. It is laxative and diuretic, and a decoction is given in piles, stone in the bladder, gonorrhœa and syphilis.

In Cambodia an infusion of the wood is given in paludism. The whole plant is considered depurative.

Burma: Momaca, Yactagyiben, Yactakyee—; *Cambodia*: Rey tuk—; *Gond*: Sundeh—; *Indo-China*: Bo song, Rey tuk, Ri ri—; *Konkan*: Sherana—;

Kumaon: Kandayar—; *Kurku*: Jeljambu—; *Lao*: Kai—; *Lepcha*: Mongthel, Mung-thel kung—; *Malayalam*: Katalluri—; *Mundari*: Garahuri, Garahuru—; *Nepal*: Kholaruis—; *Philippines*: Lumanaja, Mimbre—; *Sanskrit*: Kshudrapashanabheda, Pashanabedaka—; *Santali*: Gurjor, Sunukui—; *Tagalog*: Agoyoy, Agucuc, Balanti, Dumanai, Lumanai—; *Telugu*: Cheppunjerinjal, Taniki—; *Uriya*: Jamla—; *Visayan*: Mayagos, Mayoyos, Miayos.

HURA.

The genus consists of 2 tropical American species.

Hura crepitans Linn., indigenous in tropical America, has been introduced into India from Jamaica.

The juice of the bark is a Brazilian remedy for leprosy. It is considered caustic and irritant in Guiana and Mexico, and is said to cause blindness. At Guadas the latex is used as a fish poison.

In Mexico and Guiana the leaves are much used for chronic pains; the fresh seeds are emetic and purgative and in great demand; the oil from the seeds is said to be a useful though very drastic purgative.

The bark and the latex are officinal in Portugal.

Canarese: Retidani—; *English*: West India Sandbox Tree—; *French*: Arbre du diable, Sablier, Sablier élastique—; *French Guiana*: Maman cacao, Sablier, Sablier élastique—; *Indo-China*: Ba dau tay, Diep tay, Ngo dong—; *Mauritius*: Sablier—; *Portuguese*: Assacu, Oassacu—; *Surinam*: Postentree—; *Tamil*: Mullarasomam—; *Telugu*: Simaburuga—; *West Indies*: Sandbox Tree—; *Youri-Taboca*: Oassacu—.

JATROPHA.

This genus includes 160 tropical and subtropical species, chiefly American.

The following species are used medicinally in Arabia— *J. glandulifera* Roxb.—; in Cambodia, Indo-China, the Philippine Islands and Guiana— *J. Curcas* Linn., *J. multifida* Linn.—; in Mexico— *J. macrorhiza* Benth.—; in South America and the West Indies— *J. Curcas* Linn., *J. gossypifolia* Linn., *J. multifida* Linn.—; in Gold Coast— *J. Curcas* Linn., *J. gossypifolia* Linn.—; in West Africa, Madagascar, La Reunion— *J. Curcas* Linn.—; in South Africa— *J. capensis* Sond., *J. hirsuta* Hoch., *J. Zeyheri* Sond.—.

A. Evergreen tree or large shrub	
1. Leaves simple and ovate or 3-5-lobed	2. *J. glandulifera.*
2. Leaves long-petioled, orbicular-cordate or 3-5-lobed or angled	1. *J. Curcas.*
B. Shrubs	
1. Leaves entire or 3-lobed, base cuneate, lobes entire.	5. *J. nana.*
2. Leaves 5-lobed or -partite, lobes glandular-serrulate ...	3. *J. gossypifolia.*
3. Leaves long-petioled, orbicular, palmately cut into many narrow entire or lobulate caudate acuminate segments	4. *J. multifida.*

1. **Jatropha Curcas** Linn. is an evergreen shrub, indigenous to America, but cultivated in most parts of India, especially on the Coromandel Coast and in Travancore. It is a common hedge-plant in the Konkan, and in the Malay Peninsula.

According to Ayurvedic practitioners 'the fruit and the seed are anthelmintic; useful in chronic dysentery, thirst, urinary discharges, abdominal complaints, biliousness, anæmia, fistula, and diseases of the heart'. The oil is reckoned a valuable external application to itch, herpes, chronic rheumatism, and sores or wounds.

The leaves are applied as a rubefacient and discutient, and a decoction of them is said to excite the secretion of milk in women. The viscid juice which flows from the stem upon incision is painted over cuts and wounds to check bleeding and promote healing.

In Goa the root-bark is applied externally in rheumatism. In the Konkan it is rubbed with a little asafoetida and given with buttermilk in dyspepsia and diarrhoea; the fresh stems are used as a tooth brush to stop bleeding from the gums.

The roasted nuts are used as a purgative by the Mundas, one nut producing three or four stools.

In Cambodia the leaves are considered insecticidal, the latex styptic, the oils from the seeds abortive.

The leaves are extensively used in the Cape Verde Islands, in the form of decoction and cataplasm to the mammae, as a lactagogue. The Bakwiri of Cameroons add a decoction of the young leaves to beer as a diuretic for rheumatism.

In Nigeria a decoction of the leaves with native natron is used by women as a wash for a month before childbirth. In Gambia the leaves are used to make a mouth-wash. In Southern Nigeria they are a remedy for jaundice, applied by rectal injection.

In West Africa the sap of the plant is used to cure toothache. It is also used as a styptic, for stopping bleeding. It is said to blind the eyes. The bark of the roots is ground and used as a dressing for sores.

In Western Ashanti the leaves are burned and the ashes applied to guinea worms, which are said to come out quickly in consequence.

The seeds are used in native Hausa medicine; the oil extracted from them is used as an application for sores in domestic stock. In Gabon the seeds are ground and mixed with palm oil to kill rats.

The oil from the seeds is applied topically in Guinea in rheumatism, herpes, and pruritus. The juice of the plant and the pounded leaves are applied to wounds and refractory ulcers.

In Gold Coast the leaves are ground and used with pounded palm nuts to make a mixture which is used as an enema for weak babies to strengthen them. They are also used for smoking bedbugs out of a house. They are often crushed in water and used as an enema. The juice of the leaves is squeezed into water, lemon or lime added, and the liquid used as a bath for curing fever. When the young leaves are boiled, the liquor is drunk to cure fever also. The seeds are commonly used as a very effective purgative. Sometimes they are used in curing eye trouble.

Indians in Natal use the seeds as a purgative.

The wood is used in Madagascar and Guiana as an anti-diarrhœic; the latex is applied to decayed teeth and to wounds, and is used as a styptic; the roots are given as emetic and purgative.

The seed is a Brazilian anthelmintic; the principle is contained in the embryo.

The blacks of Rio Nunez saponify the oil with the ashes of the Papaw, and use the preparation to heal the wounds caused by circumcision.

A toxalbumin, curcin, is present in the seeds.

Ada : Kwadidicho— ; *Agolo* : Ubolu, Ubwolu— ; *Agona* : Kaneadua— ; *Akim* : Nkrangye dua— ; *Akwapim* : Aborotortor— ; *Anang* : Mbubok— ; *Antilles* : Fève d'enfer, Herbe du Bon Dieu, Herbe du diable, Mancenillier bénit, Médicinier bénit, Médicinier des Barbades, Noix américaine, Pignon de Barbarie, Pignon d'Inde— ; *Antsianaka* : Valavenola, Voanongo— ; *Arabic* : Dandebarri, Dandenahri, Habb el meluk— ; *Ashanti* : Akanedua— ; *Awka* : Elu— ; *Awuna* : Krorti— ; *Bambara* : Baga-ni, Iridingue— ; *Baoule* : Propo— ; *Bengal* : Baghbarinda, Bagbherenda, Bonbheranda, Erandagachh, Paharierand, Safedind— ; *Benin* : Aru-ebo— ; *Bete* : Badaguigui— ; *Betsimisaraka* : Kizika— ; *Bhil* : Ratan— ; *Bobo-Dioula* : Manan-naga— ; *Bobo-Fing* : Daya-naga— ; *Bombay* : Irundi, Jaiphal, Jepal, Kurikarlu, Maraharalu, Mogalieranda, Yerand— ; *Brazil* : Figo do inferno, Mandubiguasu, Munduyguasu, Pinhao do Paraguay, Pinhao de purga, Pinhao paraguay, Pinheiro do inferno, Pinheiro de purga— ; *Burma* : Kesugi, Thinbankyekku, Thinbaukyeksu, Thinbawkyetsu— ; *Cambodia* : Lohong khvang sa— ; *Canarese* : Adaluharalu, Bettadaharalu, Bettaharalu, Doddaharalu, Dundiga, Kadandla, Kaduharalu, Karnochchi, Maraharalu, Maraharlu, Maraharuli, Marayavudula, Parangiharalu, Turukaharalu— ; *Cape de Verde* : Pulguiera— ; *Ceylon* : Kaddamanakku— ; *Chinese* : Ma Fong Chou— ; *Cuba* : Piñon botija— ; *Deccan* : Ehanduejot, Erundi, Jangli-yarandi— ; *Efik* : Eto-mkpa— ; *Egypt* : Habb-el-meluk— ; *English* : Barbados Nut, Physic Nut, Poison Nut, Purging Nut— ; *Ewe* : Babatsi, Gbomagboti, Kpoti, Krorti— ; *Fanti* : Aburokyiriaba, Adadze— ; *Formosa* : T'ung yu-shu— ; *French* : Grand médicinier, Grand pignon d'Inde, Gros ricin, Haricot du Pérou, Manioc bâtard, Médicinier, Oignon d'Inde, Pignon des Barbades, Pignon d'Inde, Pourghère, Pulguère, Purghère, Ricin d'Amérique— ; *French Guiana* : Médicinier— ; *French Guinea* : Barané— ; *Fulani* : Kidi, Koladebbe, Kolakolaje, Kwolkwolaje— ; *Ga* : Kplukacho— ; *Gaboon* : Ogombo— ; *Gbari* : Kwotewi— ; *German* : Purgirnuss, Schwarzelrechnuss— ; *Golunga Alto* : Mupuluca— ; *Guam* : Tubatuba— ; *Gujerati* : Jamalgota, Jangliarandi, Ratanjota— ; *Hasada* : Kulaiaradaru— ; *Hausa* : Binidazugu, Chinidazugu— ; *Hindi* : Bagberenda, Bagbherenda, Baghrandi, Bhernda, Jangliarandi, Pharierand, Safedarand, Safedind— ; *Hova* : Tanantanambazaha, Tanantanamposy, Tanantanankisoa— ; *Ibibio* : Etomkpo— ; *Ibo* : Buluolu, Okweni, Olulu-idu, Owulu-idu— ; *Ilocano* : Tavatova, Tawatawa— ; *Indo-China* : Ba dau me, Ba dau nam, Coc dau, Dau me, Dong thu, Kuang, Lohong, Vao, Vong dau ngo— ; *Java* : Dijarak— ; *Kolani* : Kulajara, Kulejera, Totkabendi— ; *Konkani* : Erond, Erondd, Jemphal— ; *Kontagora* : Binidazugu— ; *Krepi* : Abrortorto— ; *Krobo* : Kitigblaicho, Kutugblaicho— ; *Lambadi* : Ranniarendero— ; *La Reunion* : Pignon d'Inde— ; *Madagascar* : Kinampotsy, Kinanafotsy, Kinapotsy, Kinopotsy— ; *Malay* : Jarak b'landa— ; *Malayalam* : Kattavanakku— ; *Malinke* : Bagha, Baha— ; *Mandingo* : Baga, Bagauro, Bagha— ; *Marathi* : Mogalieranda, Ranayerandi— ; *Mauritius* : Pignon d'Inde— ; *Melghat* : Mogali yerand— ; *Mende* : Katawi, Kata-wului— ; *Mexico* : Avellanes purgantes, Sangregaod— ; *Misahohe* : Wabati— ; *Mozambique* : Sassi— ; *Mundari* : Jadabindi, Totkabindi— ; *Naguri* : Kulabindidaru, Totkabindidaru— ; *Nepal* : Kadam— ; *Nzima* : Taprika, Tapuleka— ; *Ibu* : Okwata, Ubwolu— ; *Orissa* : Baigab— ; *Pahouin* : Ofossn tang— ; *Panama* : Arbol santo, Coquillo, Jaquillo, Piñon de purga, Tapate— ; *Persian* : Dandebarri, Dandenahri— ; *Philippines* : Bolongcauit, Casta, Cator, Kator, Tavatava, Tuba— ; *Porto Rico* : Tartago— ; *Portuguese* : Grão malucco, Grão muluco, Pinhao de purga, Pulza, Purgheira, Purgueira, Ricino maior— ; *Quittah* : Abrortorto— ; *Sakalave* : Savoa, Valavelo, Voanongo— ; *Samoa* : Puavai— ; *Sanskrit* : Akhuparnika, Chitra, Dravanti, Kananeranda, Mushikaparni, Nyagrodhi, Parvateranda, Pratyakshreni, Randa, Shanbari, Sutashreni, Vrisha— ; *Santali* : Bhernda— ; *Saora* : Peddanepalemu— ; *Serere* : Tabanani— ; *Sierra Leone* : Bagauro— ; *Sinhalese* : Endaru, Erandu, Rata-endaru, Velendaru— ; *Soussou* : Baranè, Barhane, Baxane— ; *Spanish* : Arbol de los Piñones de Indias, Piñoncillo— ; *Tagalog* : Tatataba— ; *Tamil* : Adalai, Kadalamanakku, Kaitta, Kattamanakku, Kattukkottai, Kuribaravuni, Naligadi, Nikkurottam, Tiravadi, Vellaiyamanakku— ; *Telugu* : Adaviyamudamu, Katiyamudamu, Kondamudamu, Nepalemu, Peddanepalemu, Pepalemu—; *Timne*: Esigororopetr—; *Tivi*: Igadam—; *Tulu*: Kadalambudu—; *Twi*: Aborotortor, Akanedua, Nkrangyedua—; *Uriya*: Baigoba, Norokokalo—; *Visayan*: Casla—; *Wolof*: Tuba—; *Yoruba*: Botije, Botuje, Botuje-ubo, Loboluje, Olobontuje, Shenrijun, Ubo—.

2. **Jatropha glandulifera** Roxb. is common near villages in Bengal, Burma, the Northern Circars, and the Deccan, rare in Oudh and the Punjab. One of the most abundant of hedge plants in the lower provinces, but also prevalent on village waste lands.

The juice of the plant is used in various parts of the country as an escharotic to remove films from the eyes.

The root brayed with water is given to children suffering from abdominal enlargements. It purges, and is said to reduce glandular swellings.

The fixed oil from the seeds has purgative properties. It is applied to sinuses, ulcers, foul wounds, ringworm, and also in rheumatism and paralysis.

Arabic: Abab, Kharub—; *Bengal*: Lalbherenda—; *Bombay*: Janglierandi, Undarbibi—; *Canarese*: Kariturukahalugida, Totlagida—; *Hindi*: Janglierandi, Undarbibi—; *Kolami*: Verendi—; *Konkani*: Ranerandi—; *Malayalam*: Atala, Nakadanti—; *Marathi*: Jangliarandi—; *Persian*: Baide anjira—; *Sanskrit*: Nikumbha—; *Tamil*: Adalai, Eliyamenakku, Erikkaraikattamanaku, Kattamanaku, Puliyamanakku—; *Telugu*: Dundigamu, Dundigapu, Nelaamida, Nelanepalemu, Nepalemu, Nelayamudamu, Vettiyamudamu—; *Urdu*: Jangli eranda—; *Uriya*: Simanorokokalo—.

3. **Jatropha gossypifolia** Linn. is a native of Brazil naturalized in many parts of India. It is now established in Burma and Singapore.

A decoction of the bark is used as an emmenagogue.

The leaves are applied to boils and carbuncles, eczema and itches.

The seeds act as an emetic; but they are said to cause insanity.

In the pith of the old thick stems a yellowish-brown substance is found which is sold in Gold Coast medicine markets. It is put into a clean cloth and squeezed into the nostrils, causing the patient to sneeze and effectively curing headache.

In Gold Coast the leaves and the seeds are used as purgatives. The leaves are boiled and used in the bath to cure fever. Their juice is used to cure sores on the tongues of babies.

Antioquia: Tuá-tuá—; *Ashanti*: Kaagya—; *Bambara*: Baga, Bagha, Baha, Santanan—; *Bengal*: Lalbherenda—; *Benin*: Oru-ebo—; *Canarese*: Kariturukaharalu—; *Ewe*: Babatsi, Gbomagboti, Nakrakpoti—; *Fanti*: Aburokyiraba, Akandedua—; *Ga*: Engmelbii, Kpitikpitsho—; *Hindi*: Bhernda, Verenda—; *Ibo*: Akimbogho—; *Kolami*: Bhernda, Verenda—; *Lagos*: Lobotuje pupa—; *Malayalam*: Simayavanakku—; *Malinke*: Baga, Bagha, Baha—; *Mandingo*: Baga, Bagha, Baha—; *Mende*: Katawi, Kata-wului—; *Oloke-meji*: Olobontijepipa—; *Panama*: Frailecillo, Frailejon, Purga de fraile, Purga de Huane—; *Santali*: Bhernda, Verenda—; *Tamil*: Adalai, Kattamanakku, Simaiyamanakku—; *Telugu*: Nepalemu, Simanepalemu—; *Uriya*: Rangakalo—; *Venezuela*: Tuá-tuá—; *Yoruba*: Botuje pua, Lapalapa pupa, Lobotuje, Olobontuje—.

4. **Jatropha multifida** Linn. is a native of South America, cultivated and naturalized in various parts of India.

The seeds are regarded as a powerful purgative. In French Guiana they are used fresh as a purgative and emetic.

In Cambodia the leaves, the latex, and the oil from the seeds are used medicinally. The leaves are used in scabies; the latex is applied to wounds and ulcers; the oil is used both internally and externally as an abortifacient.

In Indo-China the dried root is given as a decoction for indigestion and colic; it is also prescribed as a tonic, in orchitis and in oedema.

Benin: Iboisa—; *Brazil*: Flor de coral, Pinhoen—; *Cambodia*: Lohong khvang kraham—; *Canarese*: Sime auvdala, Vilayatiharalu—; *English*: Coral Plant, French Physic Nut, Purging nut, Small Physic Nut—; *French*: Arbre corail, Médicinier bâtard, Médicinier d'Espagne, Noisetier purgatif, Petit médicinier—; *French Guiana*: Bouquet corail—; *Ilocano*: Mana—; *Indo-China*: Bach phu tu—; *Lagos*: Ege—; *Mauritius*: Arbre corail—; *Sanskrit*: Bhadradanti, Brihaddanti, Dugdhagarbha, Guchhphala, Jayavaha, Jyotishka, Virechani, Vishabhadra—; *Spanish*: Avellana purgante de Santo Domingo, Piñol de Cumaña, Purgante de España—; *Tagalog*: Mana, Tuba—; *Tamil*: Kattunervalam, Malaiyamanakku—.

5. **Jatropha nana** Dalz. is found in the Deccan, in stony places near Poona, Bombay, and throughout the Konkan.

The juice is employed as a counter-irritant in ophthalmia.

Marathi: Kirkundi—.

MACARANGA.

The genus includes 180 species, occurring in the tropics of the Old World.

M. huraefolia Beille is used medicinally in tropical West Africa.

Leaves deltoid-ovate, peltate, entire. Evergreen tree, 50-60 ft. ... ... 1. *M. indica.*
Leaves peltate, entire. Small resinous tree ... 2. *M. peltata.*

1. **Macaranga indica** Wight is found in Sikkim up to 3,000 feet, the Mishmi and Khasia Hills, the Deccan Peninsula, the Andaman Islands, and Ceylon.

The gum is applied to sores.

Kumaon: Ramalo—; *Malayalam*: Puthatamara—; *Malkot*: Papri—; *Sinhalese*: Kenda—; *Tamil*: Vuttuttamara—.

2. **Macaranga peltata** Muell.-Arg. is found on the hills of Orissa and the Circars, and on the Ghats from the Konkan to Travancore. It is abundant in Ceylon, up to 3,000 feet.

The gum, powdered and made into a paste, is reckoned a good external application for venereal sores.

Bombay: Chanda—; *Canarese*: Chandakanne, Chandkal, Chenthakanni, Chinthakanni, Jatiyuppalige, Kanchupranti, Kanjupparanti, Upaligi, Uppalige, Upparanti—; *Ceylon*: Vaddakkanni—; *Kadir*: Pimugam—; *Kanara*: Chandkal—; *Konkani*: Chandori—; *Malayalam*: Pattavanni, Uppila, Vatta—; *Marahi*: Chanda, Chandoda, Chandora, Chandwar—; *Matheran*: Chandara—; *Mayurbhanj*: Tabhari—; *Mysore*: Chenthakanni—; *Sinhalese*: Bukenda, Kenda, Patkenda—; *Tamil*: Vatta, Vattikanni, Vattittutti—; *Telugu*: Boddi, Kondajaphara, Kondatamara, Pulichinjalamu—; *Uriya*: Gondaguria, Piania—.

MALLOTUS.

The genus includes 120 species, found in the tropics of the Old World.

M. apelta Müll.-Arg., *M. cochinchinensis* Lour., *M. furetianus* Müll.-Arg., *M. philippinensis* Müll.-Arg. are used medicinally in Indo-China; *M. japonicus* Müll.-Arg. is used in Japan; *M. philippinensis* Müll.-Arg. in the Philippine Islands; *M. oppositifolius* Müll.-Arg. in Nigeria and Gold Coast.

Capsule echinate or woolly; stamens 45 to 100 ...	1. *M. cochinchinensis.*
Capsule not spiny; stamens 40 to 50	2. *M. philippinensis.*

1. **Mallotus cochinchinensis** Lour. is very common in the secondary jungle and woods of Burma, the Malay Peninsula, the Malay Islands, Cambodia, Indo-China, and China.

The root and the fruit are applied topically to bruises in Indo-China.

Indo-China: Bai bai, Bet, Bo, Bong bet, Giay, Plan—; *Malay*: Balik angin—.

2. **Mallotus philippinensis** Müll.-Arg. is found throughout tropical India; along the foot of the Himalaya from Kashmir eastwards, ascending to 5,000 feet; all over Bengal and Burma, Singapore, and the Andaman Islands; and from Sind southwards to Ceylon. It is distributed to China, the Malay Islands, New Guinea, and Australia.

The leaves are bitter, cooling; give appetite; cause flatulence and constipation. The glands on the fruit are pungent, heating; purgative, anthelmintic, vulnerary, detergent, maturant, carminative, alexiteric; heal ulcers and wounds, tumours, stone in the bladder; useful in bronchitis, diseases of the abdomen, enlargement of the spleen (Ayurveda).

The glands and hairs on the fruit are bitter; anthelmintic, styptic; lessen intestinal pain; useful in scabies, ring-worm, and other skin diseases (Yunani).

Among the Mundas of Chota Nagpur the root, well ground, is rubbed on the painful parts in articular rheumatism. The root is used internally by the Arabs for leprosy, and in solution to remove freckles and pustules.

The leaves, fruit, and root with honey are applied to poisoned bites, bruises, ring-worm, pimples and freckles.

In Katha, Burma, the seeds are ground to a paste, and applied to wounds and dah cuts.

The powder prepared from the fruit is used as an anthelmintic, vermifuge and purgative medicine. It is also said to possess cathartic properties. This powder, which is known as 'Kamala' and consists of the small glands and hairs on the ripe fruits, is officinal in Austria, Germany, Hungary, Italy, Japan, Portugal, and Switzerland.

In most European and American works it is stated that Kamala has long been used in India in the treatment of tapeworm; but neither literature nor tradition bear this out. It would appear from results obtained recently under controlled conditions that the value of the drug as an anthelmintic has been greatly overrated. As for its antidotal properties they have been experimentally disproved by Mhaskar and Caius in the case of cobra and daboia venoms.

Akola: Kunkumphal—; *Almora*: Roli—; *Arabic*: Kampileh, Kinbil—; *Assam*: Gangai, Jaggaru, Puddum—; *Banda*: Kamela, Reoni, Roli—; *Bengal*: Kamalagundi, Kamila, Tung—; *Berar*: Kuku, Sendri—; *Betul*: Kunkuma, Rauni, Rori—; *Bhil*: Shendrya—; *Bijnor*: Kamela, Ruinia—; *Birbhum*: Dholasinua—; *Bombay*: Kamala, Kamela, Kapela, Kapila, Ruhin, Shendri—; *Bundelkhand*: Rori—; *Burma*: Tanthieden, Tawtheeteng, Tawthidin—; *Canarese*: Chandrahittu, Ettunalige, Honne, Hullichellu, Kapila, Kesari, Kesarimavu, Kunkuma, Kunkumada, Kunkume, Munnaga, Punnaga, Purushatunga, Surahonne, Suraparni, Suvarnakesari, Vasare—; *Central Provinces*: Chamargular, Ningur, Rauni, Rori—; *Ceylon*: Kamalama, Kapila—; *Darjeeling*: Sinduri—; *Deccan*: Kambhal, Kamila, Ruin, Ruli, Wussunthagunda—; *Dehra Dun*: Raini—; *English*: Monkey Face Tree, Spoonwood—; *Garhwal*: Rohni, Roini, Ruina—; *Garo*: Chinderpang, Machugan—; *Gond*: Koku—; *Gujerati*: Kapilo—; *Haldwani*: Roli—; *Hindi*: Kamala, Kambhal, Kambila, Kamela, Kanula, Kamud, Raini, Rauni, Rohni, Roini, Roli, Rora, Ruin, Ruli, Rulu, Wassanthaganda—; *Ilocano*: Buas, Vuas—; *Indo-China*: Aloang lay sa lang, Ba bet, Bae thau, Buom, Canh kiến, Du ma thich, Ema da, Giay rung, Skuoi—; *Jaunsar*: Kambel—; *Kadir*: Manjanai, Maunana, Ponni—; *Kashmir*: Kaimbil—; *Kharwar*: Rori—; *Kolami*: Garasinduri—; *Kumaon*: Rauni, Reru, Riuna, Roli, Ruen—; *Lambadi*: Dholo—; *Lepcha*: Numboonghor, Puroa, Purva, Tukla—; *Lohardugga*: Rori—; *Malayalam*: Chenkolli, Kapila, Kuramatukka, Manjana, Maunana, Piponnakam, Ponnakam, Ponni, Poonagam, Punna, Tavitu—; *Mal Paharia*: Daosindra—; *Marathi*: Shendri, Shindur—; *Matheran*: Asli, Rohen—; *Melghat*: Kuku—; *Merwara*: Senduria—; *Michi*: Baraiburi, Sindurpong—; *Mundari*: Garisinduri—; *Nepal*: Safedmallata, Sinduria—; *Nimar*: Kunkuma, Rauni, Rori—; *North-Western Provinces*: Purvahung, Sinduria—; *Oudh*: Rohni—; *Persian*: Kampileh, Kanbela—; *Peshawar*: Kambalia—; *Punjab*: Kamal, Kambal, Kamela, Kumila, Reini, Reun, Rulya—; *Queensland*: Poodgee-poodgera—; *Ramnagar*: Roli—; *Sanskrit*: Bahupushpa, Chandra, Kampilla, Kampillaka, Kapila, Karkatha, Kesara, Laghupatraka, Lohitanga, Madhuka, Nadivasa, Pikaksha, Punnaga, Punnagakesara, Punnama, Raktachurnaka, Raktanga, Raktaphala, Ranjaka, Rechanaka, Rechani, Rechi, Rochana—; *Santali*: Rora—; *Shan*: Tawthadin—; *Sinhalese*: Hamparandella, Hamparila, Kamala—; *Tagalog*: Banato, Sala—; *Tamil*: Avam, Kabilam, Kabilappodi, Kamala, Kambosam, Kapila, Kopilapodi, Kungumam, Kurangumanjanatti, Manjanai, Suvanagesari, Tavattai, Tiruchalai—; *Telugu*: Adavigubbatuda, Benduruppu, Chendiramu, Kunkuma, Nagarakta, Sinduragunda, Sinduri, Tunga, Vasantagandhamu, Veligarapu—; *Tulu*: Ponne—; *Urdu*: Kalileh—; *Uriya*: Bosontogundi, Kunkumo, Kopilogundi, Punango, Sinduri, Sindurogundi—; *Visayan*: Sala—; *Zambales*: Apuyot—.

MANIHOT.

The genus consists of 150 American species, mostly Brazilian and Mexican.

M. loureirii Pohl, a native of Cochin-China, is used medicinally in China; *M. ultilissima* is used in Brazil, Guiana, and Cambodia.

Manihot ultilissima Pohl is cultivated in various parts of India.

In Cambodia the pounded tuber is applied to ulcerated wounds. It is considered antiseptic in Brazil, and is used to preserve meat; as an ointment it is reputed useful in ulcers of the cornea.

The juice is very poisonous. In Guiana it is boiled down to a syrup and given as an aperient. The fresh rhizome is made into poultice and applied to ulcers.

The fruit is used as a fish poison in California and in Brazil.

The starch is officinal in Holland.

Ashanti: Bankye—; *Bafo*: Makwamba, Ngabo, Ngawa, Sanagal—; *Bahamas*: Bay Rush, Bitter Cassava, Cassava, Manioc, Tapioca—; ***Bakundu***:

Kasara—; *Bakwiri* : Mionde—; *Balondo* : Ewa—; *Balong* : Sanagal—; *Bambara* : Bananiku—; *Banda* : Ngali—; *Basari* : Banking, Kambohando—; *Batanga* : Ewa—; *Bemoba* : Jangbwanguyuya—; *Benin* : Bobozi, Ebobozi, Igari, Igarimakole, Ikeripia—; *Betsileo* : Balahazo, Mangahazo—; *Betsimisaraka* : M' Bazaha—; *Bota* : Makwamba—; *Brazil* : Mandioca, Maniba, Manioc, Manira—; *Cambodia* : Kdouch—; *Canarese* : Kadugenasu, Maragenasu—; *Central America* : Yuca—; *Dagomba* : Bankye, Kambonjule—; *East Africa* : Mhogo—; *Ebrie* : Bede—; *Efik* : Ibo iwa, Iwa unenge, Okpo ofop iwa—; *English* : Bitter Cassava, Brazilian Arrowroot, Cassava, Tapioca Plant—; *Ewe* : Agbeli—; *Fanti* : Bankye—; *French* : Mandioc, Manioc, Manioc doux, Manioque, Pain des nègres—; *French Guiana* : Manioc, Manioc amer, Manioc petit Louis—; *Fufulde* : Mbai—; *Fulani* : Bantara, Nyambe—; *Ga* : Duade—; *Gold Coast* : Bantshi, Duaday—; *Guam* : Mandioka, Mandiuka, Mendioka, Mendiuka, Yuka—; *Hausa* : Baushin kurege, Doyar kundu, Kandirin beguwa, Karaji, Karaza, Rogo—; *Hindi* : Sakarkanda—; *Hova* : Vomangahazo—; *Ibo* : Abacha, Abaja, Akbo, Akbonkono, Akbunkolo, Akpu, Akpu-ji, Ji-akpu, Ji-gbo, Oi-akpu—; *Jamaica* : Cassada—; *Java* : Hoci dangdua—; *Kabure* : Mbaumhae—; *Kano* : Rogo—; *Kanuri* : Garisa—; *Kissi* : Yambale, Yambale fulalei—; *Konkomba* : Akombanul—; *Konno* : Tanga—; *Koranko* : Banake, Tankaso—; *Krepi* : Gbedi, Gbeli—; *Krobo* : Agbeli—; *Limba* : Kopintan—; *Loanda* : Quisaca—; *Lokko* : Bororanga—; *Losso* : Bondoronde—; *Madagascar* : Kajaha, Kazaha, Matreoka, Ropotra, Tsiveritelo, Vihazo—; *Malinke* : Bananku, Bananku gue, Bara bananku—; *Mamprussi* : Kukulajo—; *Mandingo* : Mandioca, Nyambo—; *Mano* : Bai, Bei—; *Mauritius* : Manioc—; *Mbonge* : Kasara—; *Mende* : Tangei, Rande, Nguwo—; *Mexico* : Huacamotl—; *Mundari* : Edelsangga—; *Nigeria* : Bara banankou—; *North America* : Brazilian Arrowroot, Cassava, Manioc, Tapioca Plant—; *Nupe* : Rogo, Rogo dzurugi—; *Nzima* : Bairdair—; *Portuguese* : Mandioca, Pau de farinha—; *Roumanian* : Manioc—; *Russian* : Manioc—; *Sakalave* : Ambazaha, Balafanapaka, Mohogo—; *Sherbro* : Yeke—; *Shuwa Arabic* : Baghut, Nagasha—; *Sinhalese* : Manyokka—; *Sobo* : Madaka, Medaka—; *Spanish* : Mandiiba, Maniba del Brasil, Manihot amarga, Manioc amarga, Mondioca, Yuca, Yuca amarga, Yuca brava, Yuca casave de las Antillas, Yuca casavi de las Antillas, Yuca mortifera—; *Susa* : Yoka, Yoka-fore—; *Tagalog* : Caomtingcahoy—; *Timne* : Ayoka Batsanka, Ekanda, Erogbo, Nafange, Yoka-ibi—; *Tivi* : Rougou, Vambeyon—; *Tschandjo* : Kungola—; *Twi* : Bankye—; *Vai* : Dumbai—; *Visayan* : Camotingcahoy—; *Uruguay* : Mandioca—; *West Africa* : Mandioca—; *West Indies* : Yuca—; *Wolof* : Gniambi, Nyambe—; *Yalunka* : Kunde, Kunde-ghrabi-na—; *Yoruba* : Ege—.

MICRODESMIS.

The genus consists of 2 species, one Asiatic, and one African.

M. caseariaefolia Planch. is used medicinally in Indo-China; *M. puberula* Hook. and *M. Zenkeri* Pax. in tropical West Africa.

Microdesmis caseariaefolia Planch. occurs in Tenasserim, and is found in woods and forests all over the Malay Peninsula. It is distributed to Borneo and South China.

The fresh sap is used in Indo-China for caries of the teeth.

Indo-China : A luan te he, Chanh oc, Dock ko bang—; *Malay* : Chateng, Chereh rambeh, Kenidei badak, Sigoniah—.

PHYLLANTHUS.

The genus includes 500 species, temperate and tropical, absent from Europe and northern Asia.

The following species are used medicinally in Indo-China— *P. elegans* Wall., *P. Emblica* Linn., *P. Niruri* Linn., *P. reticulatus* Poir., *P. urinaria* Linn.—; in China— *P. Emblica* Linn.—; in the Philippine Islands— *P. Niruri* Linn., *P. reticulatus* Poir., *P. urinaria* Linn.;— in Colombia— *P. ichthyomethius* Rusby, *P. salviaefolius* H.B.K.—; in Brazil— *P. conami* Sw., *P. lathyroides* H.B.K., *P,* *Niruri* Linn.—; in Guiana— *P. conami* Sw., *P. epiphyllanthus* Linn., *P. guyanensis* Klotsch, *P. Niruri* Linn., *P. urinaria* Linn.—; in the West Indies— *P. Niruri* Linn.—; in Lagos and Gold Coast— *P. amarus* Schum. and Thonn., *P. discoideus* Muell.-Arg., *P. floribundus* Müll.-Arg., *P. Niruri* Linn., *P. pentandrus* Schum. and Thonn., *P. reticulatus* Poir., *P. Wildemannii* Beille—; in Madagascar— *P. casticum* Soy.-Will., *P. madagascariensis* Muell.-Arg.—; in La Reunion— *P. casticum* Soy.-Will., *P. Niruri* Linn., *P. phillyreaefolius* Poir., *P. urinaria* Linn.—.

A. A large deciduous tree; bark flaking conchoidally; branchlets slender, pubescent. Leaves equal and symmetrically set ... ... 2. *P. Emblica.*

B. Shrubs or small trees; leaves 1 in. or more long.
  I. Capsule small .1 in. through or less, fleshy. Pedicels slender rather long ... ... 5. *P. reticulatus.*
  II. Capsule long-pedicelled, dehiscent, .1 to .5 in. long. Leaves ovate-lanceolate glaucous beneath, 4 in. long. 1. *P. elegans.*

C. Herbs, occasionally wiry at base; leaves distichous small.
  I. Quite herbaceous; leaves oblong or elliptic obovate; capsule smooth ... ... 4. *P. Niruri.*
  II. Slightly woody at base; leaves linear-oblong; capsule echinate ... ... 7. *P. urinaria.*
  III. Nine inches to 2 ft. tall with long branches, leaves close set very narrow.
    a. Leaves linear or oblong-linear; flowers pedicellate. 6. *P. simplex.*
    b. Leaves cuneate-obovate; flowers sub-sessile ... 3. *P. maderaspatensis.*

1. **Phyllanthus elegans** Wall. is found in Tenasserim, at Mulmein, Mergui, and Amherst; in the Malay Peninsula, on stream banks in Pulau Adang islands and Rawei.

In Indo-China the roots are considered antiperiodic. The juice of the pounded leaves is given to children with aphthae.

In Tongking the leaves are made into a salad and given for fatigue.

Indo-China: Bo ngot, Bu ngot, Hac rien than—.

2. **Phyllanthus Emblica** Linn. is found, wild or planted, throughout tropical and subtropical India; from the base of the Himalaya, from Jummu eastwards, and southwards to Ceylon and Malacca; whence to the Malay Islands and China.

This plant occupies an important place in Hindu Materia Medica, and the medicinal properties of its various parts are described at length in the Nighantas: 'The fruit is acrid, sour, bitter, sweetish; cooling, alexiteric, carminative, alterative, laxative, tonic, antipyretic; useful in burning sensations, vomiting, biliousness, urinary discharges, thirst, leprosy, constipation, inflammations, erysipelas, piles, anaemia, strangury; used in biliousness, thirst, sweats, anura, poisoning, ophthalmia, incipient blindness.—The leaf is used in opthalmia and incipient blindness.—The seed is acrid, sweet; aphrodisiac, antipyretic; useful in biliousness, asthma, bronchitis, leucorrhœa, vomiting.'

Mohammedan physicians esteem the plant equally with the Hindus. According to Arabic and Persian authors; 'The flowers are cooling and aperient.—The fruit is acrid, sour, cooling; astringent, tonic, expectorant, vulnerary, laxative, improves the appetite; useful in diseases of the heart, liver complaint, cold in the nose, thirst, piles, biliousness, eye troubles; stops nasal hæmorrhage; purifies the humours of the body.'

The root, the bark, and the ripe fruit are astringent. The flowers are refrigerant and aperient.

The unripe fruit is cooling, diuretic, and laxative. The exudation from the incisions on the fruit is used as an external application in inflammation of the eye.

In the Konkan the juice of the fresh bark with honey and turmeric is given in gonorrhœa.

The leaves are, in Baroda, used as an infusion with fenugreek seeds in cases of chronic dysentery, and are also considered a bitter tonic. In the same locality the milky juice is considered a good application to offensive sores.

The leaves enter into the composition of a Mundari expectorant.

In the Tamil country the calcined fruit is powdered with an equal weight of flower tops of *Mollugo nudicaulis* Lam., made into a paste with milk, and given for uterine hæmorrhage during pregnancy.

In Cambodia the leaves are used in the preparation of antithermic lotions and baths, and the decoction of the roots is given in myalgia following upon some febrile condition.

Arabic: Ambliy, Amlaj—; *Assam*: Amlaki, Amluki, Sohmyrlain—; *Bengal*: Ambolati, Amla, Amlaki, Amlati, Amlika, Amulati, Aonla, Aunlah, Yeonlah—; *Betul*: Aonla—; *Bombay*: Amla, Avala, Avalkati, Avla—; *Burma*: Hziphyu, Shabju, Siphiyusi, Tasha, Zibyu, Ziphiyusi—; *Cambodia*: Ngop—; *Canarese*: Amalaka, Chattu, Dadi, Dhanya, Dhatri, Nelli, Sudhe—; *Central Provinces*: Amla, Anla—; *Canton*: Yeou Kan Tse—; *Chinese*: An Mo Le—; *Cuttack*: Alathanda—; *Deccan*: Amla, Owla, Ownla—; *English*: Emblic Myrobalan Tree—; *Garo*: Ambari—; *Gond*: Aunri, Lalla, Milli, Nalli, Nilli, Usir—; *Gujerati*: Amali, Ambala, Ambri, Amla, Bhoza, Bhoza amali—; *Hindi*: Amalachi, Amla, Amlaki, Amlika, Anola, Anuli, Anvula, Anvurah, Anwerd, Aola, Aonla, Aora, Aungra, Aunra, Aunwered, Daula—; *Indo-China*: Bong ngot, Kam lam, Kamlan ko, Yem ma lac—; *Khond*: Durga—; *Kol*: Miral—; *Kolami*: Aura, Miral—; *Konkani*: Anvallo, Dogranvalli, Dogranvallo—; *Kumaon*: Aonla—; *Kurku*: Aunre—; *Lambadi*: Ambla—; *Lao*: Ma kam paum—; *Lepcha*: Pa-om kung, Suom—; *Malayalam*: Amalakam, Nelli—; *Marathi*: Anvala, Aola, Aonli, Avala, Arola, Awla, Bhuiawalai—; *Mauritius*: Embélic—; *Mundari*: Meraldaru—; *Nepal*: Amla—; *Nimar*: Aonla—; *North-Western Provinces*: Amla, Aoula—; *Persian*: Amelah, Amuleh—; *Portuguese*: Mirabolano emblico—; *Punjab*: Ambal, Ambli, Ambul, Amla, Aonla—; *Sanskrit*: Adiphala, Akara, Amalaki, Amamalakam, Amlika, Amraphala, Amrita, Amritaphala, Bahuphali, Dhatri, Dhatrika, Dhatriphala, Jatiphala, Karshaphala, Kayastha, Pancharasa, Rochani, Shanta, Shiva, Shriphala, Shriphali, Tishya, Tishyaphala, Triphala, Vayastha, Vrishya, Vrittaphala—; *Santal*: Meral—; *Saora*: Peddavusirika—; *Sinhalese*: Awusadanelli, Nelli, Nellika—; *Tamil*: Amalagam, Andakoram, Indul, Kattunelli, Nelli, Perunelli, Sirottam, Tattiri, Toppunelli—; *Telugu*: Amalakamu, Amalaki, Nelli, Pullayusirika, Triphalamu, Usirika, Usirikaya, Usiriki—; *Tulu*: Nelli—; *Urdu*: Anwala—; *Uriya*: Aura, Khondona, Onola—.

3. **Phyllanthus maderaspatensis** Linn. is met with throughout the drier parts of India, from Banda through the Deccan Peninsula

to Ceylon. It occurs also in tropical Africa, Arabia, Java, and Australia.

In Southern India an infusion of the leaves is given for headache.

The seeds are used medicinally on account of the mucilage which they afford when soaked in water.

Arabic: Cholf, Marur—; *Gujerati*: Kanochha—; *Hindi*: Hazarmani, Kanocha, Kanochha, Niruri, Sadamanni—; *Matheran*: Kanocha—; *Persian*: Marurshatu—; *Porebunder*: Bakrado—; *Sind*: Niruri, Sadamanni—; *Telugu*: Nalausereki—; *Urdu*: Kanochha—.

4. **Phyllanthus Niruri** Linn. is found throughout the hotter parts of India, from the Punjab eastwards to Assam, and southwards to Travancore, Ceylon, and the Malay Peninsula, ascending the hills to 3,000 feet. It inhabits the tropics generally, except Australia.

Hindu physicians credit the plant with the same therapeutical properties as *P. urinaria*; they, moreover, use the leaves as a diuretic and in menorrhagia.

According to Mahommedan physicians the plant is stomachic, good for sores and in chronic dysentery; the fruit is bitter, useful for tubercular ulcers, wounds, sores, bruises, scabies, and ringworm.

The plant is much used as a diuretic in dropsical affections, gonorrhœa, and other troubles of the genito-urinary tract. It is a South Indian diuretic and antidysenteric. In Indo-China it is reputed to be diuretic, depurant and antisyphilitic. In La Reunion it is very much used in blennorrhagia, dropsy, and diarrhœa.

The fresh root is said to be an excellent remedy for jaundice. In the Konkan it is rubbed down with rice water and given as a remedy for menorrhagia. Bruised with a little water and administered internally with milk, it is a popular Tamil galactagogue. In the Rajputana Desert the root, pounded and mixed with *Commiphora mukul* Engl., is given to camels suffering from indigestion.

The leaves are stomachic. A poultice of the leaves with salt cures scabby affections, and without salt may be applied to bruises and wounds; made with rice water the poultice lessens œdematous swellings and ulcers.

In Gold Coast the leaves are pounded and used to cure gonorrhœa. Parts of the plant are used to cure constipation. The leaves are boiled and the liquor drunk to stop acute pains in the stomach. The chief use of the plant is to allay griping in cases of dysentery.

The milky juice is a good application to offensive sores.

The bark is used as a purgative and in the treatment of various diseases, and yields a bitter principle 'phyllanthin', which is a fish poison.

An infusion of the young shoots is given in dysentery.

The infusion of the root and leaves is a good tonic and diuretic, when taken cold in repeated doses.

The decoction of the root and leaves is very bitter and is a favourite remedy among the natives of Santo Domingo and Porto Rico, for the cure of intermittent fevers. I have myself many times proved its efficacy in preventing the expected paroxysm. I was accustomed to employ a tincture made by myself with the whole plant, the dose being two drachms in the morning. Sometimes I repeated the dose, which acted upon the bowels as a slight purgative and this is very useful in inveterate intermittents with infracts of the spleen and liver. The infusion of the root and leaves is a good tonic, and a diuretic when taken cold in repeated doses (A. J. Amadeo; *Pharmaceut. Journ.*, April 28, 1888).

A decoction of the bitter root and leaves is given in Haiti for stomach-ache.

An aqueous extract or a decoction of the fresh roots, stem, and leaves is given internally in snake-bite (Roberts); but the root, stem, and leaf, are all useless as an antidotal treatment (Mhaskar and Caius).

Arabic: Mekatkata, Meneckete—; *Ashanti*: Bommaguwakyi—; *Bengal*: Bhujamla, Kiraneli, Sadahazurmani—; *Bombay*: Bhuiavala—; *Brazil*: Erva pombinha—; *Burma*: Miziphiyu—; *Canarese*: Kiranelligida, Kirinelligide—; *Ceylon*: Vellaikkilkaynelli—; *Chinese*: So Cheu—; *Deccan*: Bhuinavalah—; *Efik*: Oyomo-ke-iso-amon-ke-edem—; *French*: Herbe du chagrin—; *Ga*: Ombatoatshi—; *Guam*: Maigo-lalo, Maigu-lalo—; *Gujerati*: Bhonya anmali—; *Hindi*: Bhonya abali, Bhuinanvalah, Jangli amli, Jaramla, Niruri, Sadahazurmani—; *Ibibio*: Oyomo-ke-iso-amon-ke-edem—; *Indo-China*: Cho de—; *Java*: Aijlaunmahaij—; *Krobo*: Ofobiokpab—; *La Reunion*: Petit tamarin blanc—; *Malayalam*: Kirganelli, Kizhanelli, Kizhkkayinelli—; *Marathi*: Bhui avali—; *Mauritius*: Curanellie blanche, Herbe au chagrin—; *Mundari*: Muikoa kantara, Pirikantara—; *Nupe*: Ebogi, Ebo zunmaggi—; *Philippines*: Hierba de San Paulo, Hierba de San Pedro—; *Porebunder*: Bhonya anmari—; *Portuguese*: Erva poubinha—; *Rajputana*: Gugerati bawal—; *Sanskrit*: Adhyanda, Ajata, Ajuta, Amala, Amlika, Amrita, Aphala, Bahupatra, Bahupatri, Bahuphala, Bahupushpi, Bhudatra, Bhudhatri, Bhumyamalaki, Bhuparva, Charati, Chorata, Dalaparshini, Dridhapadi, Hilolika, Jada, Jharika, Jhatamala, Kshetramali, Mala, Nilolika, Putrashronika, Shiva, Sukshmadala, Sukshmaphala, Uchchata, Vishaghni, Vishvaparni, Vitunnaka, Vituntika, Vrishya—; *Seychelles*: Herbe au chagrin—; *Sind*: Niruri—; *Sinhalese*: Pittawaka—; *Spanish*: Yerba de quinina, Yerba de quinono—; *Tamil*: Kilanelli, Kilkkaynelli—; *Telugu*: Nelausirika, Nelavusari—; *Twi*: Bommaguwakyi—; *Urdu*: Bhui amla—; *Uriya*: Bhui aola—; *West Indies*: Petit tamarin blanc, Quinine créole, Yerba de quinino—; *Yemen*: Mekatkata, Meneckete—; *Yoruba*: Yoloba—.

5. **Phyllanthus reticulatus** Poir. is common throughout tropical India, Burma, Malaya, and Ceylon. It extends to the Malay Islands, China, and tropical Africa.

The fruit is astringent to the bowels; useful in inflammations, and diseases of the blood (Ayurveda).

The bark is considered alterative and attenuant, and is prescribed in decoction in the quantity of four ounces or more twice daily.

The leaves are employed as a diuretic and cooling medicine in Sind.

The juice of the leaves is used medicinally in the Konkan. It is made into a pill with camphor and cubebs, which is allowed to dissolve in the mouth as a remedy for bleeding from the gums. It is also reduced to a thin extract along with the juice of other alterative plants and made into a pill with aromatics; this pill is given twice a day, rubbed down in milk, as an alterative in heat of the blood.

In Lakhimpur the juice of the leaves is used for diarrhœa in infants.

In Ashanti the leaves are mixed with palm nuts (*Elæis guineensis*) and made into a broth, which is given to newly delivered women to relieve them.

In Gold Coast the stems are used to cure sore eyes, the juice from them being blown into the eyes.

The Rongas and Europeans of East Africa use the powdered leaf as a local application to sores, burns, and suppurations, and chafing of the skin. The Rongas also apply it to venereal sores.

In Indo-China the plant is used in the treatment of smallpox and syphilis.

Akola: Pithor, Pittur—; *Assam*: Amluki—; *Bengal*: Panjuli—; *Bombay*: Pavana—; *Canarese*: Anamsula, Chippulinellu, Huli, Karesuli, Karihuli, Sannahagesoppu—; *Deccan*: Buinowla, Kalemadhkajhar—; *Fanti*: Nkokobro—; *Gorakhpur*: Sikat—; *Gujerati*: Datwan—; *Hausa*: Alambu, Alambu na tudu, Bak' in alamba, K'alambu—; *Hindi*: Buinowla, Kalemadhkaper, Makhi, Panjoli, Panjuli—; *Indo-China*: No kang pa, No phen den—; *Katagum*: Tsah—; *Konkani*: Kaili—; *Lambadi*: Kombhoiro—; *Malayalam*: Kattuniruri, Kilanelli, Nirnelli, Niruri—; *Marathi*: Pavan—; *Melghat*: Pithor, Pittur—; *Merwara*: Kabonan—; *Nimar*: Kamoi—; *Punjab*: Panjuli—; *Rajputana*: Kabonan—; *Ronga*: Tetenya—; *Sanskrit*: Bahupraja, Bahupushpa, Kamboji, Kambojini, Krishnakambhoji—; *Sind*: Kamohi, Kamohijopun, Kamu, Pikapiru—; *Sinhalese*: Welkyla—; *Tagalog*: Malaiba, Malatinta, Tinatinam, Tintatintahan—; *Tamil*: Abirangi, Karuppuppilanji, Karunelli, Kattukkilanelli, Melanelli, Nirppul, Nirppula, Nirppulanji, Pul, Pula, Pulanji—; *Telugu*: Nallapuli, Nallapurugudu, Nelapurugudu, Pandibarangi, Pulisar, Purugud—; *Timne*: Egbeli—; *Tulu*: Kakesoppu—; *Twi*: Awobe—; *Uriya*: Bonotihudi, Jojangi, Phajoli—; *Visayan*: Matangolang, Sungotolang—; *Yoruba*: Iranje—; *Zamboanga*: Nipin—.

6. **Phyllanthus simplex** Retz is found in the plains and low hills throughout India, from Kumaon to Assam and southwards to Travancore, Ceylon and Malacca, ascending to 6,000 feet. It is distributed to China, the Malay and the Pacific Islands.

The natives use the fresh leaves, flowers and fruit, with cumin seeds and sugar, of each equal parts made into an electuary, for the cure of gonorrhœa, a teaspoonful is given twice a day. The fresh leaves, bruised and mixed with buttermilk, make a wash to cure the itch in children.

The root is used in Chota Nagpur as an external application for mammary abscess.

Gujerati: Motibhonya anmali—; *Indo-China*: Vay oc—; *Marathi*: Bhuiavali, Motibhuiavali—; *Mundari*: Otemeral, Pirimeral—; *Porebunder*: Motibhonya anmari—; *Santali*: Tandimeral—; *Telugu*: Uchchiyusirika.

7. **Phyllanthus urinaria** Linn. is met with throughout India, from the Punjab to Assam, Burma, Malacca, Penang, and Ceylon; it is common in Singapore and Selangor. It inhabits the tropics generally.

The fruit and plant are acrid, sour, cooling, bitter, sweetish; alexipharmic; useful in thirst, bronchitis, leprosy, anæmia, urinary discharges, anuria, biliousness, asthma, hiccough (Ayurveda).

The plant is much used as a diuretic in dropsical affections, also in gonorrhœa and other genito-urinary troubles.

In Chota Nagpur the root is given to sleepless children, In La Reunion the plant is considered diuretic, sudorific, depurative, and emmenagogue. It is given as a drink in dysentery and cystitis.

In Cambodia the plant is used as a bitter, tonic, astringent, and febrifuge. An infusion is given for liver complaint, diarrhœa and paludism.

Bengal : Hazarmani— ; *Burma* : Miziphiyuani— ; *Cambodia* : Prak phle— ; *Canarese* : Kempukiranelli— ; *Ceylon* : Chivappukkilkaynelli— ; *Chinese* : Ko Cheu— ; *Gujerati* : Kharsadabhonya anmali, Kharsadabhonya ansari— ; *Hindi* : Hazarmani, Lalbhuinanvalah— ; *Indo-China* : Cho de, Giap ha chau, Kho ham, Prak phle— ; *La Reunion* : Petit tamarin rouge— ; *Malay* : Ambin buah— ; *Malayalam* : Chirukizhukanelli, Chukannakizhanelli— ; *Marathi* : Lalmundajanvali— ; *Matheran* : Lalbhiuawali— ; *Mauritius* : Curanellie rouge, Curanellie urinaire— ; *Sanskrit* : Adhyanda, Ajata, Ajuta, Amala, Aphala, Arudha, Bahupatra, Bahuphala, Bahupushpa, Charati, Chotata, Dalasparshini, Drirdhapadi, Hilkolika, Jada, Jharika, Jhatamala, Mala, Nilolika, Putrashronika, Shiva, Sukshmadala, Sukshmaphala Tali, Tamalika, Tamalini, Tamravalli, Uchchata, Vishaghni, Vishvaparni, Vitunnaka, Vituntika, Vrishya— ; *Santali* : Badarzhapi— ; *Sinhalese* : Binnelli, Ratpittaawka— ; *Tagalag* : Ibaibaan— ; *Tamil* : Shivappunelli— ; *Telugu* : Ettausirika, Yerrausereki—.

PUTRANJIVA.

The genus consists of 4 Indo-Malayan species.

Putranjiva Roxburghii Wall. is found, wild and cultivated, throughout tropical India, from the lower Himalaya in Kumaon eastwards and southwards to Pegu and Ceylon.

The leaves, the fruit, and the stones of the fruit are given in decoction in colds and fevers.

In Siam a medicine for rheumatism is made out of the leaves and fruit.

Bengal : Jiaputa, Putranjiva— ; *Bombay* : Jewanputr, Jivputrak, Putajan, Putrajiva— ; *Burma* : Badibyu, Egayit, Taukyat, Toukyap, Toukyat— ; *Canarese* : Amani, Menasinakale, Putrajiva, Putremjiva— ; *Chindwin* : Badibyu— ; *Haldwani* : Juti— ; *Hazaribagh* : Piten— ; *Hindi* : Jiaputa, Jivputrak, Joti, Juti, Patigia, Patji, Putajan, Putijia, Putrajiva, Putranjiva— ; *Kumaon* : Juti— ; *Lambadi* : Kalo— ; *Malayalam* : Pongalam, Ponkolam— ; *Marathi* : Jewanputr, Jivputrak, Jiwanputr, Putajan, Putrajwa— ; *North-Western Provinces* : Jiaputa, Joti, Juti, Putrajiva— ; *Oudh* : Patji— ; *Pegu* : Daukyat— ; *Punjab* : Jiyaputra, Patajan— ; *Ramnagar* : Juti— ; *Reddi* : Veku— ; *Sanskrit* : Ardhasadhaka, Apatyajiva, Garbhada, Garbhakara, Jivanaputra, Kumarajiva, Mavu, Pavitra, Putrajiva, Putranjiva, Shlipadapaha, Sidhida, Sutajivaka, Sutrajiva, Yashtipushpa— ; *Santali* : Pitoj, Pitonj— ; *Tamil* : Irukolli, Karupali, Karupilai— ; *Telugu* : Kadrojuvi, Kudrajinik, Kudurujivi, Kudurujivir, Mahaputrajivi, Putrajivika— ; *Uriya* : Bholokoli, Pohunjona, Poichandia, Poitundia—.

RICINUS.

Ricinus communis Linn. is indigenous to tropical Africa, and is found, wild or cultivated, throughout the Tropics. By cultivation it has been distributed through not only all tropical and subtropical regions, but also in many of the temperate countries of the globe. In the south of England the plant ripens its seeds in favourable situations, and it has been known to come to maturity as far north as Oslo in Norway.

The root is sweetish, heating; carminative; useful in inflammations, pains, ascites, fever, glands, asthma, eructations, bronchitis, leprosy, diseases of the rectum, and the head.—The leaves are useful in intestinal worms, strangury, night blindness, earache; increase biliousness.—The flowers are useful in glandular tumours, anal troubles, vaginal pain.—The fruit is heating and an appetiser; useful in tumours, pains, piles, diseases of the liver and spleen.—The seed is cathartic and aphrodisiac.—The oil is sweetish; cathartic, aphrodisiac, anthelmintic, alterative, useful in tumours, diseases of the heart, slow fevers, ascites, inflammations, typhoid, pain in the back, lumbago, leprosy, elephantiasis, convulsions; causes biliousness (Ayurveda).

The root bark is purgative, alterative; good in skin diseases.—The leaves are galactagogue; good for burns.—The seeds and the oil from them have a bad taste; purgative; useful in liver troubles, pains in the body, lumbago, boils, piles, ringworm, paralysis, inflammations, ascites, asthma, rheumatism, dropsy, amenorrhœa (Yunani).

In Chota Nagpore the bark is ground and applied to burns by the Mundas. A fibre of the bark is tied round the neck to stop vomiting.

The leaf is applied to the head to relieve headache, and is commonly used as a poultice for boils. It is said to possess considerable power as a lactagogue, being applied warm to the breasts. The fresh leaves are used by nursing mothers in the Canary Islands as an external application, to increase the flow of milk. On the other hand it is generally admitted in Indo-China that the leaves act as an antilactagogue, whether applied topically on the breasts or taken internally.

In general the plant is credited with a number of peculiar properties, and is said to be useful in difficult parturition, spasmodic twitchings of the face, facial malformations, and cancer of the stomach.

The seeds and the oil from the seeds are used as a purgative wherever the plant is found growing. The Chinese use the crushed seeds more frequently than they do the oil, the paste is applied to relieve scrofulous sores. In some parts of West Africa a decoction of the leaves is taken to purge.

In Las Bela the oil is expressed and used medicinally; and a fomentation is made with the leaves to cure wounds. At Turbat in Makran it is used as an ointment for sores. At Kotra in Kachhi the leaves are used for fomentations; in Kharan they are bound over boils, and are a good cure.

In French Guinea the leaves are boiled and used as a febrifuge. In native medicine in West Africa the leaves are boiled to form a lotion for fevers, and pounded for application as a poultice to swellings. The leaf is sometimes tied on the forehead for headache. In Togo the leaves of the larger-leaved variety are crushed with cold water to form a useful eye lotion.

An infusion of the leaf is a Zulu remedy for stomach-ache. It is administered orally or as an enema. The Zulus also apply a paste of the root in toothache. In South Africa the root is the basis of several native remedies for toothache.

In Southern Rhodesia the bark is used by natives for stitching up wounds, and as a dressing for wounds and sores. The Chewas boil the root in water which has been previously boiled with the ashes of maize stalks. The sediment from the second boiling is smeared on the teeth and gums to relieve toothache, the material not being swallowed.

The Transvaal Sutos apply the powdered roasted seeds to sores, boils, etc., in children. The foliage is considered emmenagogue, the root-bark purgative, and the leaf useful as a local application in rheumatism. The local application of the leaf to the mammae is said to produce a powerful galactagogic action. In West Africa a decoction is taken internally as a lactagogue and emmenagogue.

The bruised leaves are used for caries of the teeth and given with water for colic in Madagascar.

In La Reunion the leaves are considered lactagogue and are given in infusion or applied to the breasts.

In Guiana the leaves are applied to the breasts to help the secretion of milk. Soaked in vinegar they are applied to the forehad in cases of sunstroke. They act as a powerful sudorific.

A treatment for chancre in Northern Nigeria consists in fumigation by burning stems of *Ricinus* along with those of *Calotropis procera.*

The oil, combined with citron ointment, is used as a topical application in common leprosy.

In West Africa, castor oil is not used as a medicine internally, but externally as an unguent alone or mixed with other substances, such as groundnut or other oil. It is used as an application for parasitic skin-diseases, craw-craw, etc., and as a dressing for sores and parasitic conditions in domestic stock. In South Africa a mixture of castor oil and kerosene is known as a cheap and efficient culicide in the fight against malaria. Castor oil has been found to be almost the only agent which prevents gad-flies from attacking camels for any length of time.

Rendered soft and pulpy by heat, the leaves are applied to the Guinea-worm sore to facilitate its extraction.

Ancient Sanskrit writers prescribed the seed in the treatment of snake-bite and scorpion-sting; but Caius and Mhaskar have shown experimentally that it is not an antidote to either snake or scorpion venom.

The leaves and the seeds are officinal in Portugal; the seeds and the oil in France and Italy; the oil in Austria, Belgium, Brazil, Denmark, Finland, Great Britain, Holland, Hungary, Japan, Mexico, Norway, Russia, Spain, Sweden, Switzerland, Turkey, the United States, and Yugoslavia.

Afghanistan : Bazanjir, Buzanjir—; *Afrikaans* : Kasterolieboom—; *Almora* : In—; *Amboyana* : Camiri—; *Aowin* : Ateende—; *Arabic* : Charua, Djar, Hurua, Khirurwi, Khirwa, Tebscha, zaejt—; *Assam* : Eri—; *Awuna* : Dzonggdaleng—; *Bafo* : Bokuri—; *Balong* : Bokuri—; *Bambara* : Subarabana—; *Behar* : Anda, Amar, Lenr, Renr—; *Bengal* : Bheranda, Bherenda—; *Benin* : Era ogi—; *Berar* : Yerandi—; *Betsileo* : Kinamena—; *Bombay* : Erendi—; *Brazil* : Carapateiro, Figueira d'inferno, Mannona, Nhambuguasu—; *British Central Africa* : Mbaliki—; *Burma* : Kesu, Kyeksu—; *Cambodia* : Lohong preng—; *Canarese* : Avudala, Avudalu, Chittuharalu, Eranda, Haralu, Manda, Vardhamana—; *Catalan* : Rici, Figuera infernal, Rissino—; *Central Provinces* : Grundi—; *Chinese* : Pi Ma—; *Coïmbatore* : Kotteimuttu—; *Danish* : Undertroee—; *Deccan* : Erund, Ind, Rund, Yarand—; *Dutch* : Wonderboom—;

Efik : Etighi-unenge, Eto-aran-ukebe— ; *Egypt* : Kharwa, Kiki— ; *English* : Castor-oil Plant, Palma Christi— ; *Ewe* : Dzegbele, Dzongbati, Kasuwelti, Kasuworliti, Longo— ; *Fanti* : Abronkruma, Adedenkuruma, Esusonkuruma, Sunsumnkuruma— ; *French* : Avanacoë, Avanacu, Bois de carapat, Carapat, Grand ricin, Palma Christi, Paume Dieu, Pignon de Barbarie, Ricin, Ricin commun, Ricin vulgaire— ; *French Guiana* : Palma Christi— ; *French Guinea* : Diakoula— ; *Fulah* : Diakoula— ; *Fulani* : Derre, Diakoula, Kolakolaje gor'de, Zurmaje— ; *Ga* : Abromkruma, Adedengkuruma— ; *Genoa* : Ricin, Ricinu— ; *German* : Wunderbaum— ; *Gond* : Nerinda— ; *Greek* : Kiki— ; *Guam* : Agaliya— ; *Gujerati* : Diveli, Diveligo, Tirki— ; *Hamadan* : Kercheng— ; *Hasada* : Ranggajara, Risajara— ; *Hausa* : Chika gida, 'Dan kwasare, Kulakula, Zurma— ; *Hindi* : Arand, Arandi, Arend, Arind, Erand, Erandi, Erend, Ind, Rand— ; *Hova* : Tanantanankisoa— ; *Hungarian* : Ricinus— ; *Ibo* : Obwa, Ogba, Ogili-obwa, Ogili-ogba, Ogilisi, Ogiri-aro, Osisi-ogili— ; *Ilocano* : Tangantangan, Tavatavangsina, Tawatawasinga— ; *Indo-China* : Dau dau, Du du, Huong thet, Khnhe, Lohong, Miet ma, Thu du tia— ; *Iraq* : Khirwa— ; *Italian* : Caffee da olio, Catapuzia maggiore, Erba venaria, Fagiolo d' India, Fagiolo romano, Fava d' India, Fico d' inferno, Girasole, Mirasole, Palma Christi, Palmaperta, Ricino— ; *Kabure* : Assimballo— ; *Kachhi* : Harnoli— ; *Kalabari* : Alamba-ngbole— ; *Kharan* : Murghpad— ; *Kikuyu* : Mubariki— ; *Kolami* : Jarabindi— ; *Konkani* : Erendi— ; *Koranko* : Maraban keyo barambe— ; *Kordofan* : Hurna— ; *Krepi* : Atornggor, Kasuwelti, Kasuwoliti, Yevu-tongo— ; *Krobo* : Kumenglo— ; *Kumaon* : Andi, Arandi, Indrendi— ; *La Reunion* : Ricin tantan— ; *Las Bela* : Hiranr— ; *Lepcha* : Hilk bu ruk-lop, Raklop— ; *Loanda* : Bafureira— ; *Lokko* : Tawabawa— ; *Makaran* : Murpad— ; *Malabar* : Tonda— ; *Malaya* : Jarak, Pee mah— ; *Malayalam* : Anandam, Avanaka, Chittavanaku, Erandam, Gandharvahastakam, Kotta, Panjangulam, Pantiyavanakku, Varddhamanam— ; *Malta* : Castor-oil Plant, Palma Christi, Ricino, Rionu— ; *Marathi* : Erandi, Yarandicha— ; *Masai* : Oldule— ; *Mauritius* : Palma Christi— ; *Mbonge* : Boku-balondu— ; *Mende* : Bonde, Ngele-bonei— ; *Mentone* : Ricinu— ; *Mexican* : Tlaplatl— ; *Mozambique* : Ambona— ; *Mundari* : Bindidaru, Ranggabindi, Ranggafara— ; *Naguri* : Ranggabindidaru, Risabindi, Sutamranggabindi— ; *Nandi* : Imanyet— ; *Nasirabad* : Harnauli— ; *Nepal* : Alha, Areta, Orer— ; *Nimar* : Arand— ; *North America* : Castor Bean, Castor Plant, Palma Christi— ; *North-Western Provinces* : Arand, Bhatreri, Rendi, Reri— ; *Nupe* : Kpamfini gulu— ; *Pahouin* : N'zoum— ; *Pedi* : Mokhura— ; *Persian* : Bedanjir, Bedanjira, Garchak, Karchak, Tochme kerchek— ; *Portuguese* : Carrapateiro, Mammona, Palma Christi, Ricino— ; *Portuguese Africa* : Bafureira— ; *Potenza* : Ricin— ; *Punjab* : Aneru, Arand, Arind, Bedanjir, Harnauli— ; *Pushtu* : Arhand— ; *Rajputana* : Arend, Edia— ; *Reggio* : Rizoin— ; *Roumanian* : Ritina— ; *Russian* : Kleshtshexika— ; *Sakalave* : Kinana, Tanantanamanga— ; *Samoa* : Lama-papalangi— ; *San Remo* : Ricin— ; *Sanskrit* : Amanda, Amangala, Bhanda, Chankuka, Chitrabija, Chitraka, Dirghadantaka, Eranda, Gandharvahasta, Gandharvahastaka, Ishta, Kanta, Panchangula, Panjangula, Ruvuka, Shukla, Shulashatru, Svehaprada, Taruna, Triputi, Triputiphala, Tuchhadru, Vardhamana, Vatari, Vranaha, Vuka, Vyadatvaka, Vyaghradala, Vyaghrapuchha— ; *Santali* : Eradom— ; *Sarawan* : Bedanjir— ; *Sardinia* : Cacamengiu— ; *Sibi* : Harnauli— ; *Sicily* : Rigginu— ; *Sind* : Ayrunkukri, Heran— ; *Sinhalese* : Eudaru, Telendaru— ; *South Africa* : Castor Bean, Castoroil Plant, Palma Christi— ; *Spanish* : Higuera del diablo, Higuera infernal, Palma Christi, Ricino— ; *Sumatra* : Jarak— ; *Susu* : Limbiaxule, Mbiakule— ; *Suto* : Mokhura— ; *Swahili* : Mbariki— ; *Swedish* : Undertrard— ; *Tagalog* : Lansina, Lingasina, Tangantangan— ; *Tamil* : Aimugi, Amanakku, Andagam, Asaram, Attagam, Attamanam, Attugam, Erandam, Kottai, Kottaimuttu, Muttukkottai, Peramanakku, Sanju, Sasambari, Sigandi, Sittaman, Sittamanakku, Sittiram, Tabinjam, Urppulam, Vattamam— ; *Telugu* : Amudamu, Chittamudamu, Erandamu, Peramudamu— ; *Tigre* : Kella— ; *Tigrinia* : Vulleh— ; *Timne* : An-fentoel, Lamirenda— ; *Tivi* : Harev, Ihurua dzengo, Ijija, Jija, Masev, Sherai jongo, Showara jongo— ; *Treviso* : Rizin, Rizino— ; *Tschaudjo* : Dendelle, Sau— ; *Tuareg* : Fueni— ; *Turkish* : Hint— ; *Tuscany* : Erba de latte, Erba lattaria, Girasole maggiore, Girasole piccolo, Manoaperta, Meo, Scatapuzia, Zecca, Zeccha— ; *Twi* : Abronkruma, Adadenkuruma— ; *Urdu* : Eranda— ; *Uriya* : Bheronta, Chitroko, Erondo, Gobo, Joda, Kalo, Monto— ; *Tindoko— ; Uruguay* : Ricino, Tartago— ; *Verona* : Rizino— ; *Waziri* : Randanh— ; *Xosa* : umHlavuthwa— ; *Yemen* : Jar, Tebsha, Zeit— ; *Yoruba* : Ilara, Ilarun, Laa, Lapalapa adengteng, Lara— ; *Zulu* : umHlakuva—.

SAPIUM

The genus includes 100 species, inhabiting warm countries. *S. sebiferum* Roxb. is used medicinally in China and Indo-China, *S. Grahamii* Prain in Gold Coast. The latex of *S. ellipticum* Pax is in Kenya an ingredient in arrow-poison.

Leaves shortly petioled, elliptic-lanceolate, obtusely acuminate, serrate or subserrate	1. *S. indicum.*
Leaves elliptic or oblong-lanceolate, acuminate, crenate-serrate	2. *S. insigne.*
Leaves long-petioled, ovate, orbicular-ovate or sub-rhombic, quite entire, finely acuminate	3. *S. sebiferum.*

1. **Sapium indicum** Willd. is found in the Sunderbund and in the tidal forests of Tenasserim and Ceylon. It occurs on the sea coasts of the Malay Peninsula, and is distributed to the Malay Islands and New Guinea.

The juice of this tree is reckoned of a very poisonous nature. The taste of the fruit is nauseous beyond description. The seeds are used for intoxicating fish.

Bengal : Batan, Batul, Huru, Hurua— ; *Bombay* : Hurna— ; *Borneo* : Booroo— ; *Hindi* : Hurua— ; *Malay* : Gurah, Guring— ; *Malayalam* : Karmmatti, Venkshiri— ; *Sinhalese* : Kirimakulu, Kirrimakalu—.

2. **Sapium insigne** Trim. is found in the sub-Himalayan tract, from the Beas eastwards to Assam, Chittagong, Burma, and Ceylon, ascending to 4,300 feet.

The whole tree is full of an acrid milk which, when applied to the skin, produces vesication.

Almora : Khin— ; *Anamalais* : Garpathola— ; *Bombay* : Dudla— ; *Canarese* : Kannupade, Kurda, Nanaka— ; *Dehra Dun* : Khindra, Khinna, Khinni, Khirni— ; *Garhwal* : Khindra, Khinna, Khinni, Khirni, Kinna— ; *Hindi* : Khina, Khindra, Khinna, Khiria, Khirni, Khirun, Lendwa, Lienda— ; *Kadir* : Karuppuchchulai— ; *Marathi* : Dudla, Hure, Ura, Ure— ; *North-Western Himalaya* : Boddar, Khinna— ; *Punjab* : Bilodar, Biloja, Dudla, Karalla, Ledra— ; *Telugu* : Garbhasula— ; *Tulu* : Kannupade—.

3. **Sapium sebiferum** Roxb., indigenous to China and Japan, is found as a cultivated plant in various parts of India and elsewhere in warm countries.

The acrid juice is a powerful vesicant. The oil is reputed similar to castor oil.

In China the bark is used as a tonic, and the resin as a purgative.

In Indo-China the root bark in decoction is given in dyspepsia. The fat from the seeds is used in the treatment of skin diseases.

Bengal : Momchina— ; *Chinese* : Pa Teou Seou, Wu Chiu— ; *Dehra Dun* : Tarcharbi— ; *English* : Chinese Tallow Tree— ; *Hindi* : Bilaitisissu, Vilayatishisham— ; *Indo-China* : O cuu moc, Sach, Soi, Soi tia u kiu, Soi trang— ; *Mauritius* : Arbre à suif— ; *North America* : Chinese Tallow Tree, Tankawang Fat Tree, Vegetable Tallow Tree— ; *Saharanpur* : Pahari shisham— ; *Sanskrit* : Agaru, Toyapippali— ; *Uriya* : Ronojita—.

SAUROPUS.

The genus consists of 20 Indo-Malayan species.

Sauropus quadrangularis Müll.-Arg. is found in Bihar, Chota Nagpur, and the Western Peninsula; it is common in Burma.

The dried leaves are smoked in tonsilitis.

Matheran : Chickli— ; *Telugu* : Tellavusirika—.

SEBASTIANIA.

The genus consists of 80 tropical species, mostly American.

Sebastiania chamaelea Müll.-Arg. occurs in Bihar, the Deccan Peninsula, Ceylon, Burma, and the Malay Peninsula. It is distributed to China, the Malay Islands, tropical Australia, and Africa.

The juice of the plant in wine is used as an astringent. A decoction of the plant in clarified butter is considered to be tonic, and is applied to the head in vertigo.

In Indo-China the plant is used in the treatment of syphilis and diarrhœa.

Konkaṉ : Bhui crendi— ; *Sinhalese* : Ratpitawakka—.

TRAGIA.

The genus includes 55 tropical and subtropical species.

T. volubilis Linn. is used medicinally in South America and in the West Indies.

T. *angustifolia* Benth. and *T. cordifolia* Benth. are considered toxic in Madagascar.

Tragia involucrata Linn., a common stinging weed, is found in dry places throughout India, from the Punjab and the lower Himalaya of Kumaon, eastwards to Assam and Burma, southwards to Travancore and Ceylon. It extends to China.

The root is considered diaphoretic and alterative; an infusion is given in ardent fever and in itching of the skin.

In the Konkan a paste of the root is used to aid the extraction of guinea-worm; mixed with the juice of *Ocimum sanctum* it is employed as a cure for itchy skin eruptions.

In Chota Nagpur the root is given when the extremities are cold during fever; also for pains in the legs and arms.

The root also forms the basis of an external application in leprosy.

The leaves enter into the preparation of an errhine which is prescribed in cases of headache.

The fruit rubbed over the head with a little water is useful in cases of baldness.

The root of this plant has diaphoretic property and is therefore given in fevers to cause perspiration. A decoction of this root 1 in 10 was found to be useful in relieving bronchitis and the attendant fever (Koman).

The fruit is not an antidote to scorpion venom (Caius and Mhaskar).

Bengal : Bichati, Bichiti— ; *Bombay* : Kanchkuri, Khajkhotti— ; *Canarese* : Dulagondi, Haligilu, Kiriberalu, Kiruberalu, Kiriturache, Sannaturachi, Turachi— ; *Deccan* : Kanchkure— ; *Hindi* : Baraanta— ; *Ho* : Jipenda— ; *Kolami* : Sengelsing— ; *Malayalam* : Cherukodithuva, Chorinnanam, Choriyanam, Kotittuva— ; *Marathi* : Kanchkuri, Khajkolti— ; *Matheran* : Katayi, Kulti— ; *Sanskrit* : Duralabha, Dusparcha, Dustaparisha, Grahini, Kachchura, Kasaghni, Samudranta, Virupa, Vrishchikali, Vrishchikapatri— ; *Santal* : Sengelsing— ; *Tamil* : Ambu, Cherukanjuru, Erumaikkanjori, Kanjori, Kandudi, Kannichi, Karuppukkanjori, Kunasagam, Kurundotti, Punaikkanjori, Samuttirandam, Sendotti, Siruganjori, Tanavaiyadam, Turalobam, Turpparigam, Vellaikkanjori— ; *Telugu* : Chinnadulagondi, Dulagondi, Dulagundi, Peddadulagondi, Regadadula, Revatidulagondi, Telumani, Tigedulagondi— ; *Tulu* : Pachcherengi, Turuse— ; *Uriya* : Bichati, Bichchuati—.

TREWIA.

The genus consists of 2 Indo-Malayan species.

Trewia nudiflora Linn. is common in the hotter parts of India from Kumaon southwards and eastwards to Assam, Malacca, and Ceylon. It extends to Sumatra and Java.

The plant is cooling, tonic, alexiteric; improves taste; removes biliousness (Ayurveda).

The plant is used for the removal of swelling, bile, and phlegm. The root in decoction is given to relieve flatulence and is applied locally in gouty or rheumatic affections.

Bengal : Pitali, Pitoli— ; *Bombay* : Bhillauri, Petari, Tumri— ; *Burma* : Setkadon, Thitmyoka, Yehhmyot, Yemyot— ; *Canarese* : Kadukanji, Kadukere, Kadukumbala, Kanji, Katkumbala, Katkumbla, Padye, Shillauri, Tumri— ; *Dehra Dun* : Gamhar, Tumri— ; *Haldwani* : Gutel— ; *Hindi* : Bhillaura, Gambhar, Gamhar, Khamara, Pindara, Pitoli, Tumri— ; *Kolami* : Garalohadaru— ; *Kumaon* : Khamara, Tumri— ; *Lepcha* : Tungplam— ; *Magahi* : Hruprukban— ; *Malayalam* : Kanji, Kattukumil, Malankumil, Pamarakkumil, Pambarakmubil— ; *Marathi* : Petari, Pitari— ; *Monghyr* : Gamhar— ; *Mundari* : Garalupung— ; *Nepal* : Gamari, Garum, Kurong— ; *Oudh* : Bhillaur, Bhillaura— ; *Saharanpur* : Dhaulpedda— ; *Sanskrit* : Karahata, Karangaha, Pindara— ; *Santali* : Gada lopong— ; *Tamil* : Attarasu, Attupuvarasu, Kanji, Naykkumil, Sannattuvarai— ; *Telugu* : Eruponaku— ; *Tharu* : Bilur— ; *Uriya* : Monda, Panigambhar, Pitalu, Pithaliya—.

REVIEWS.

THE BIRDS OF BRITISH SOMALILAND AND THE GULF OF ADEN. Their life-histories, breeding habits and eggs. By Sir Geoffrey Archer, K.C.M.G. and Eva M. Godman. Vols. i and ii. 63/-.

We feel that no apology is needed for bringing to the notice of the members of our Society this beautiful book on the birds of British Somaliland and the Gulf of Aden. There is a traditional connection between these areas and the Society which is evident to anyone acquainted with the back volumes of the *Journal.* No student of N.-W. India and the countries thereto contiguous can afford to disregard Somaliland and the Gulf for the light which they can throw on all problems and species connected with desert areas, for the fact that many species are common to both areas, and because many of the summer visitors and passage migrants of N.-W. India pass through or winter in the countries round the Gulf of Aden.

Sir Geoffrey Archer is well known for his thirty years' service in Africa. He is a nephew of Sir Frederick Jackson, whose book on the birds of Kenya and Uganda has just been published, and that relationship had its share in developing his interest in Natural History, and particularly in birds. In May 1914 he became Administrator of the Protectorate of Somaliland and when the status of the country was changed he became the first Governor, a post which he held until August 1922. During those years in Somaliland his leisure hours were largely given up to ornithology and by the time he left the country he had made a collection of some 3,000 bird-skins and 1,000 clutches of eggs, as well as the mass of field notes which have made this book possible. In working up this material Sir Geoffrey Archer has had the active help and collaboration of his kinswoman Miss Eva Godman who is a daughter of the late Frederick Ducane Godman, so well known to an elder generation of ornithologists.

The completed book is to consist of four volumes of which the first two have now appeared together. These show that the book will be in format an ornament to any library whether purely ornithological or more general in scope. They are handsome in appearance and the printing and paper are excellent.

The illustrations merit a few remarks. These consist of eighteen coloured plates of birds and four coloured plates of eggs as well as a number of beautiful photographs which illustrate the introduction. The plates of eggs are by Mr. H. Gronvold and are executed with the fidelity for which that name is a guarantee. The birds have been painted by the late Archibald Thorburn and will bear comparison with the best of his work. It should be remarked that this is the only book of non-British birds illustrated by Thorburn and for that reason it is bound to hold a special place in any critical study of his work. The backgrounds of the pictures, moreover, provide a good series of pictures of the scenery in Somaliland and afford an eloquent testimony to the careful collaboration between the authors and the artist which enabled the latter to paint a country that he never saw.

To turn to the text of the book it is much fuller and more readable than most faunistic works. The introductory matter is unusually interesting, occupying nearly a hundred pages. These include chapters on both the history of the country and the history of its ornithological exploration and a very full description of Somaliland and the Somali as they exist today with some very graphic pictures of the bird life typical of certain areas. These make fascinating reading, and make one long to visit a country that so far appears to have escaped the devastating march of progress. An admirable map in colours will be found at the end of the second volume.

The main text follows the system of classification which starts with the Stratheonida and ends with the Passeres. The authors admit 422 species and subspecies to their list and out of these 170 forms have been found breeding within the limits of the work. The account of each species is most ably written. Sir Geoffrey Archer is not and does not claim to be an expert systematist and his work will here and there be found lacking on the scientific side. He has however a fluent pen and a wide knowledge of his birds in the field and using these and the work of other writers in happy combination he has produced a text which is very interesting. From it the Englishman in Somaliland will learn the points of interest about his birds and how and where to find them. At the same time the worker in other areas and the general reader will find this a book that helps him to appreciate the avifauna of a country which he may never see. We can only hope that the remaining two volumes will soon appear to join their most attractive predecessors.

H. W.

AUS DEM LEBEN DER VÖGEL. By Dr. Oskar Heinroth. x+165 pp., with 98 insets of line drawings and photos. Berlin, 1938 (Julius Springer). Price 4·8 RM.

This little volume is the thirty-fourth of the series *Verständliche Wissenschaft* or Popular Science, published by the well-known house of Julius Springer. The author, Dr. Oskar Heinroth, needs no introduction to students of ornithology. His monumental work, in four profusely illustrated volumes, on Central European birds—*Die Vögel Mitteleuropas*—is the record of practically a lifetime devoted to the most thorough investigation of the life-history of almost every species found on the continent of Europe, most of which were reared, photographed and studied by him from egg upwards. As the author remarks in his Foreword, there is probably no other group of vertebrate animals about which so much has been written and yet such misconceptions prevail in the popular mind, as Birds. The object of this booklet is not to go into such purely technical matters as systematics and anatomy for which many good manuals already exist. Neither is it a purely 'popular' book on birds in general. It purports to discuss only a few aspects of bird life, but what a wide range of topics it really does cover will be readily seen from the chapter-headings in the list of contents, some of which are the following: The Chief Characteristics of Birds—How Birds Sleep—Nesting Habits—Nest-building and Breeding—The Laying of Eggs—Clutches—Does the Bird Know its Egg?—Does the Bird Recognise its Young?—Does the Incubation Period Depend upon the Size of the Egg?—Does the Size of the Egg Correspond with the Size of the Bird? Other subjects dealt with are: Cuckoo lore and Parasitism—The Egg, Development of Embryo and Growth of Young—Moult and Colouration—Food—Intelligence—Senses—Locomotion—Direction-finding, etc.

From the concise nature of the discussions backed by the authoritativeness one has a right to expect from an ornithologist of Dr. Heinroth's calibre and experience, the book is refreshing to read. In these days, when the spate of ornithological literature has become physically impossible to keep abreast of, even by a full-time ornithologist, one is otherwise liable to be left bewildered as to what is and what is not the final answer to many of the questions herein discussed.

This volume is bound to prove interesting and educative not only to the man who studies birds as a hobby, but also to the more serious student. It is our misfortune, however, that it should be in a language that will perhaps debar it to many bird-lovers in India. The illustrations are carefully selected and well reproduced and add greatly to the interest and attractiveness of the book.

S. A. A.

THE COMPLEAT INDIAN ANGLER, by John Masters, well bound and put together, covers some 115 pages of large spacious print, 34 pen and ink sketches, and 16 plates. Price 10*s*. 6*d*.

It is not a thesis on Indian fishing in the sense that Thomas' 'Rod in India' was, or even an up-to-date Anglers Hand Book or Mighty Mahseer. The author has cleverly dialogued in the shade of Isac Walton, his reminiscences of Service in India woven round his favourite sport Angling. The book makes good reading, but adds nothing new to past works. His keen knowledge of the common Indian fishes, is given in a colourful story, supported by pen and ink sketches and in order not to weary the reader he gives some amusing anecdotes of every-day life that befalls the soldier or civilian during his sojourn of service in India.

The sketches of the fish, in most cases, are excellent in outline and proportion, though the finer details of Fin Rays and scales set, so important in the identification of fish, he has neglected. In the text the author has given the scientific names and partly described the fish, but has not always supported these in his sketches. This is unfortunate and defeats his own object. The Boka (*B. hexagonolepis*) is just one example on page 26, he mentions the scales in the L. Line as 28-31, but his sketch only shows 25.

On page 101 of his book the author gives an unusual setting for Butchwa (*Ea vacha*). As far as I know Butchwa (*E. vacha*) like the broken water and eddies of slow running rivers, round and about the piers of bridges, submerged trees or where smaller streams join. They often feed in shoals when the surface is considerably disturbed. I have never seen or heard of them 'sucking in air' in the manner as set down by the author, this is surely exceptional.

He mentions 121 lbs. as the record Mahseer taken on Rod and line. Revitt Carnac, so far as I know, holds the record with his fish of 119 lbs. taken in Mysore on December 28, 1919, in the Cauvery.

His experience takes him from the North-Eastern Frontier of Assam, through Hyderabad, Sind, the Punjab and Kashmere, over to the barren N.-W. Frontier to the Tochi and Kabul.

The author wisely concludes his book with a paragraph warning the reader of the names of the fish he gives as purely local to the text of his book, and not general over all India.

Mr. Masters would have done well to have resurrected, instead, the Immortal Thomas, and brought up-to-date that classic, *The Rod in India.*

A. M.

THE TRIALS OF A PLANTER, by Oscar Lindgren; printed by S. Mani Pradhan at the Mani Press, Kalimpong; and published by the author in 1933. Price Rs. 3.

This little book of 206 pages has 34 chapters. There are 7 illustrations depicting some of the more exciting incidents and these will probably afford the reader as much pleasure and amusement as the drawing of them no doubt did to the, presumably, youthful artist.

The author was at Bloxham School, and being by nature a wanderer chafed sorely at his hard lot of polishing an office stool in the city. Fortune, a benevolent uncle, and ready replies to a Board of Examiners saved him, so he came out to India in 1877 at the age of 20 bound for the career of a Tea Planter in Assam.

The voyage to Calcutta was uneventful except for frequent stoppages to repair decrepit engines; and that up the Brahmaputra river in a paddle steamer afforded plenty of mild incident. A Captain who was somewhat of a character introduced the lad to various peculiarities of life in the East, and the sight of muggers, buffaloes, wild fowl, the varied bird-life of the great river, and the teeming human life at the various stopping places gave interest to the long voyage of 33 days to Dibrugarh.

His first 'trial' was a Manager who was more fond of a whisky bottle than tea, but he was kind to the author who became an independent Manager through his recommendation.

In the early days of Tea 'leaf rolling by hand was carried on in most of the Assam Tea Gardens, it was a slow and tedious process and with a rush of leaf it was a hard task to get a cooli man to roll his maund of withered leaf'. The rolled tea was made up into balls and left to ferment, the process being hastened by wet cloths. Firing was carried out on wire sieves over brick fireplaces. It was long before these primitive devices gave way to methods in use at the present day.

After six years the author discarded Tea and entered the career of sleeper-cutter and sleeper-contractor for the Dibrugarh-Sadya Railway the construction of which began in 1883. While working in this capacity he laid the foundations of the present settlement of Makum; and to this period obtain the tales of 'The Mad Mukna of Makum', 'A Romance of the Sabansiri River', 'A Night Encounter and its Sequel', 'The Dehing Saw Mills', 'A Man Eater', etc. etc.

A return to Tea planting was made and in 1887 he was opening a new tea garden in the Dibrugarh district on the Dehing river 'in a howling muddle of forests and undergrowth'; 'a white woman was as scarce as a white elephant and the less said about the way we dressed the better'. Malaria was bad and the life a hard one. About this time he saw something of elephant keddah operations and there were various fishing and shikar excursions with Miri tribesmen, of whom he speaks well.

In the chapter 'Some Snakes I have met' we read of his escape from an angry hamadryad which he afterwards shot. It measured 17 feet. A planter saves himself from another of the species by holding his coat to the furious snake. Then there was an attack on his boat by a big black snake which might have been a king cobra except that its underside was a dull red. On the wrapper of the book is a coloured picture of a large snake in typical cobra attitude which is perhaps intended to represent a hamadryad; but it is banded like a krait. The youthful artist drawing on his imagination? By the way, is there such a weapon as 'a smooth bore rifle'? And do domestic cattle eat green tea bushes? This is not known in South India.

Some chapters are devoted to voyages and incidents unconnected with life as a planter. There is 'The Wreck of the S. S. Delhi' in 1911; 'A Visit to Canada', etc. Then there is a description of the Darjiling earthquake of 1897, and of a great flood one year which did much damage along the Rangeet and Teesta rivers and in the Darjiling district.

The putting together of this small book of reminiscences has no doubt afforded much pleasure to Mr. Lindgren and been of interest to his friends. It is a great pity the proof reading was not more carefully done for every page is full of misspellings and faulty annotation.

R. W. B.

THE KANDY FLORA. By A. H. G. Alston. Pp. xvii+109. Colombo: Government Record Office, 1938. Price Rs. 3·50.

This is a sure and safe guide to the identification of the flowering plants found within easy walking distance of Kandy. Simple, reliable keys are given for families, genera, and, when needed, for species; and there are 404 good illustrations. The book opens with an excellent account of 'formations' or 'associations', and ends with a useful glossary of botanical terms.

The statement in the foreword that the book 'has been prepared for the use of the Schools' and that its 'price has been kept down as low as possible in order that purchase may be within the means of every student' invites criticism from this side of Adam's Bridge where Rs. 3·50 is an amount that few school-going boys or girls could afford to pay.

We do not know the Ceylon Government rules about the spelling of vernacular names, but the transliterations '*ch*' and '*chch*' in some of the Tamil names leave us pensive.

J. F. C.

UGANDA GAME DEPARTMENT, Annual Report for the year 1937.

What should be the functions of a Game Department? This must immediately occur to the mind of any Conservationist reading the Annual Report of the Game Department of the Uganda Protectorate for 1937. I do not think that a correct answer can be found in this report.

Section I dealing with Administration gives some illuminating details regarding the successful financial position of the department and discloses the fact that a very large profit is made from the sale of ivory, chiefly obtained by the destruction of elephants under an activity called 'elephant control'.

The small amount of the total revenue which is placed at the disposal of the Game Warden is significant.

An expenditure of £6,554 only out of a gross revenue of £21,072 seems to be a poor percentage for what should be the chief work of a Game Warden, i.e. the Conservation of Wild Life.

Detailed expenditure on such work is not given in the report, although commercial statistics are given at considerable length. At two auctions held in Mombasa during the year the average price of ivory per pound realized Shs. 7/68 and Shs. 7/10, compared with Shs. 6 and Shs. 6/55 in 1936. The price of ivory seems to be an important factor and is mentioned several times in the report, but does not appear to help the Game Warden to obtain more funds for Wild Life Conservation. Here are one or two examples showing how little of the large balances is given for the work of the Game Warden.

In 1926 the revenue of the Uganda Game Department was £12,316, expenditure £6,691, leaving a balance of revenue over expenditure of £5,625.

In 1934 the revenue was £11,676, expenditure £5,111, leaving a balance of revenue over expenditure of £6,565.

In 1937 the gross revenue was £21,072, expenditure £6,554, actually less than in 1926, leaving a balance of revenue over expenditure of £12,818, after deducting £1,700, estimated cost of internal and external transport of ivory.

Evidently in Uganda there is no relation between the money received from wild-life resources and the expenditure to conserve the same resources. The value of the yard-stick appears to be unrecognized.

It must be remembered that the revenue does not include the fees collected from registration of sporting firearms, etc. It does include the fees from Game Licences.

The magnitude of the business may be gathered from the fact that 44,577 pounds of ivory were sold during the year, as well as 31½ pounds of rhino horns and 309¼ pounds of hippo teeth, realizing the sum of £16,507. We are then given in paragraph 6 under Ivory, etc., statistics showing stocks in hand at the end of the year.

A chapter headed 'Illegal Killing of Game and Breaches of Game Laws', is quickly disposed of. No details here. No information regarding numbers of prosecutions, amounts of fines, etc. But the market value of ivory comes into the picture as affecting breaches of the law.

Commencing with paragraph 11 a chapter headed 'Game Reserves', which one might imagine would be the most important and informative chapter in the book, is colourless, sketchy and disappointing in the bareness of all interesting detail.

In view of what I have written about ivory and lower down about 'elephant control' I should like to point out that in this chapter 'Game Reserves'—it only takes up about three-quarters of a page—no information is given regarding:

(1) Staff for the protection of the game reserves.
(2) Steps taken for the guarding of the reserves.
(3) Details regarding the expenditure on reserves.

But we are told that plenty of game was seen and observed. We are not told how many reserves there are or what is their acreage.

A little food for thought is given to us about the Damba Island Reserve. We are told that it is impossible to guard Damba Island effectively but we are not told why, unless the effect of the inhabited island of Kome is the excuse. With a surplus of nearly £13,000 of revenue over expenditure such an impossibility should be impossible.

A chapter headed 'Game Trophies' contains some interesting statistics regarding the elephant trophies obtained. A total of 337 elephants were shot under licence. The price of ivory seems to be an influencing factor in the sport of elephant hunting in Uganda according to paragraphs 15 and 18 in this chapter. Incidentally it is mentioned that 2,627 tusks of ivory weighing 77,118 pounds, valued at £27,046 passed through Uganda from the Belgian Congo.

In Section II, 'Elephant Control', we find the report getting down to the real thing. Here perhaps is the chief activity of the Game Department and if meticulous detail is a criterion it *is* the chief activity.

Paragraph 25 reads as follows:

'Owing to the absence on leave of both Game Rangers during the greater part of the year control operations in certain important localities have become somewhat disorganised and this, combined with frequent restrictions on elephant hunting in rinderpest infected areas, has resulted in a considerable falling off in the numbers killed under organised control. In spite of these drawbacks, however, the results can be considered satisfactory. . . .'

Satisfaction appears to consist in the numbers of elephants killed. The absence of the Game Rangers appears to have saved us from accounts of wonderful feats and paeans of hearty congratulations such as have appeared in previous reports.

We are told that the reference to decreasing damage in certain District reports is most heartening. We were told much the same thing in 1926, yet the toll of increasing killings has steadily gone up until this year and this falling off in 1937 is reported to be due to shortage of staff. We have a plethora of statistics. Twenty-six African 'control' guards were employed, and in the control area 1,519 elephants were killed, mostly, I presume, by the guards. In addition to this other elephants paid the extreme penalty because 228 tusks were found in the control area which can, I think, be taken as from elephants wounded by the operations of the control.

Of the first figure of 1,519 elephants about half of the number had tusks weighing under ten pounds, which means that they were taken from immature males and females. Of the second number of 228 tusks, about half came within the same category. There are no details showing the proportion of cow ivory but it is fairly evident from the figures shown that a large number of small elephants must have been killed by the control. The African control guards came in for their share of praise.

We then have under several chapters detailed accounts of damage by and destruction of elephants in the different provinces. In these accounts it is shown that licence holders obtained some fine trophies. Details are given of incidents in connexion with the work of the control. It is to be presumed, from lack of all information on the subject, that no other methods than killing are undertaken to effect any control over elephant herds which cause depredations.

In Section III we have 'Notes on the Fauna'. Unfortunately practically nothing appears in this report about Gorilla, although there has been, I believe, considerable agitation to obtain a gorilla sanctuary in Uganda. If this sanctuary is a *fait accompli* one would have expected to hear something about it; if not one would expect to be told why nothing has been done. But there is always a good deal to be found in this report about the misdeeds of the fauna and this section is no exception. Baboons, red monkeys, leopards, lions, buffaloes, rhinoceroses, hippopotamuses, giraffes, bush pigs and zebras, as well as elephants, are all indicated.

The chapter on Birds is interesting and instructive. The list of recoveries in Uganda during 1937 of White Storks, ringed in Europe, is no doubt of great scientific interest.

Under reptiles we have a long reference to a crocodile known as Lutembe. I think the Game Warden presumes that Lutembe is as well known to the rest of the world as it is to him, but as this report may be read by many whose knowledge even of Uganda is somewhat vague, much more vague must be their knowledge of Lutembe, and a little enlightenment on the subject would have been useful. Crocodiles are not popular and efforts were made by the Game Department to deal with them by setting poison baits (phosphorus) at Katebo which were believed to have been successful.

In Section IV 'General' under a chapter headed 'Notes of General Interest' we are informed that a party of eminent South Africans had a splendid view of Lutembe. On reading this for the first time I thought it referred to a mountain! This chapter ends the references to mammals and we now turn to Section V, Fisheries.

The chapters in this section give very detailed statistics of the fishing industry in Uganda. The mass of detail collected is a great testimony to the industry of the Game Department. The economics of the business are thoroughly gone into and much information of great commercial value is to be found in this section.

The fisheries, while being of vital importance to the natives are, one would have thought, so far as a Game Department is concerned, a consideration which should take a second place after the mammal fauna, especially the larger fauna, which can, through lack of proper care and careful conservation, very easily disappear.

The conclusion drawn from a study of this report is bound to leave the impression that the dominating factor governing the major activities of the Game Department is 'control'. One cannot help coming to such a conclusion, it may be a wrong conclusion but due to the meagre information regarding the important work of conservation and the emphasis placed on the importance of 'control' there is to my mind no alternative.

The numbers of elephants known to have been killed in Uganda during the last ten years—there must have been other deaths—amount to over 14,000, mostly killed by an organization especially formed to kill them. At least that is what the Uganda Game Department's Reports lead us to believe.

In the report for 1937 we have records of the killing of—

337 elephants by licence holders.
1,519 elephants by the Game Department.

and approximately 120 elephants found dead, based on found ivory; a total of 1,976 dead elephants.

Uganda is not a very big country, about 223,500 square miles, less than twice the area of the British Isles. The continual drain on the elephant herds is a heavy one.

Can they stand it? That is the first question.

Is it necessary? That is the second question.

Is the motive purely altruistic? That is the third question.

Is there no alternative? That is the fourth question.

No answers will be found in the report, because the information on which to base such answers are not there.

We can, however, draw certain deductions. The large revenue from the sale of ivory is not used for the conservation of wild life nor for steps to counteract the depredations of wild life except on a basis of destruction. In other words the killing of large numbers of elephants is, at present, a profitable business.

If there was no profit, if elephants had no tusks, would the official killings reach these figures?

If this question can be answered in the affirmative it means that no important significance attaches to the revenue obtained from the ivory sales? Therefore one is led to ask why this large revenue is not used to conserve wild life, utilized in research work, or expended on works to try to overcome the elephant difficulty?

If on the other hand the large revenue is appreciated as profit for general expenditure, while at the same time it is clear that little money is allocated to conservation work, then the elephant is being exploited for gain.

Many years ago an officer of a Game Department in Africa said words to this effect:

> 'The key note of successful conservation of wild life is the prevention of killing for profit.'

with which sentiment every conservationist will agree.

Perhaps Government profit and individual profit are two different matters? That may be so; but the principle applies to both profits.

I believe that I am correct when I write that scientists in many parts of the world view with alarm the destruction of wild life in Africa. The present policy being followed in Uganda may or may not be necessary; we cannot form a complete judgement from the accounts given to us by those responsible for the destruction.

Some of the Annual Reports of the Uganda Government Game Department have been disturbing to conservationists and distressing to many others. It seems that the time has come when an impartial inquiry should be held by persons expert in the art of practical conservation of wild life into this question of the organized destruction of elephants and other large fauna.

It would take a long time to make a thorough inquiry. It would cost a lot of money. But it would not cost as much money as the annual profit the Uganda Government are making out of the sale of government ivory.

June 19, 1938. T. H.

MISCELLANEOUS NOTES.

I.—PANTHER WITH ABNORMAL FEET.

Writing to the Society in connection with two panther skins sent to them for mounting by H. H. the Maharao of Cutch, Messrs. Van Ingen & Van Ingen state 'You might be interested to know that one of these panthers has two extra phalangeal bones and claws—twenty in all'. In vol. xxx, p. 909 of the Journal (1925) the Maharaj Kumar Shree Vijayarajji of Cutch published a photograph and a note on a panther with an extra claw-bearing toe on each hind foot, and in a recent letter H. H. the Maharao commenting on the reference to his trophy made by Messrs. Van Ingen & Van Ingen says 'This is the third one I have shot having the same character. All three have been found in more or less the same part of Cutch. Apparently the extra toe in some cases is hereditary.' The recurrence of these abnormalities within the area appears to indicate that His Highness' suggestion is possibly correct. In vol. xi, p. 734 of our *Journal*, Mr. S. Eardley-Wilmot refers to a panther shot by him in Oude, with five fully developed claws and toes on each hind foot.

BOMBAY. S. H. PRATER.
May 30, 1938.

II.—JACKALS (?) AND A CAPTIVE PANTHER.

I have just recently read Mr. F. W. Champion's book entitled *With a Camera in Tiger-land* and was very much interested in his remarks on leopards and hyaenas in the chapter entitled 'Hyaenas and others'. In July 1936 I came into possession of a young male leopard some four months old and I kept this animal which was perfectly tame until December of the same year when I gave him to the Zoo at Trivandrum, Travancore. During the time the animal remained in my possession he occupied a fairly large cage in my compound with a bare earth floor, and on many occasions on my visiting the leopard in the early morning I found that holes had been burrowed under the edge of the cage presumably so that the burrowing animal could steal scraps of food which had been left. After keeping watch several times on hearing my dog bark late one night I ran around to the cage and found the panther hiding behind a small box and a couple of animals engaged at a piece of meat which had been purposely given extra to the leopard in his evening meal. Immediately on hearing me the 'raiders' made off and as far as I could make out they were only ordinary jackals or perhaps wild dog. I thought it rather amazing that the leopard should endeavour to hide from the marauders but did not think it worth recording until I had read Mr. Champion's book. It should be observed that, although on every occasion raids were made holes were made which were big enough to let the leopard walk out without any difficulty, he made no attempt to do so but instead appeared next day very much cowed.

QUILON, TRAVANCORE,
SOUTH INDIA.
February 22, 1938.

NOEL J. S. THOMPSON,
F.R.S.A., F.Z.S., A.I.A.A.

III.—PANGOLIN AND SAMBAR: A CURIOUS BELIEF.

We publish below an extract from the Chief Forest Officer's Report of 11th February 1938 to the Administrator, Bastar State.

'I may say that though I have not seen the Pangolin in this State (Bastar) but I am certain that it does exist for the reasons given below:—

(1) That it is a nocturnal animal, and moves slowly and hence the chances of locating it in forests are few and far between.

(2) That the bony scales of this animal are made into finger rings and buckles by professional men in Jagdalpur and other villages and sold to the patients suffering from rheumatic diseases. The writer of this note in his recent tour was seriously offered a set of rings and buckles made of Pangolin scales at Ulnar camp to relieve the nerve pains.

This harmless creature certainly requires protection, otherwise it would be wiped off completely. I suggest a thorough survey of this animal through S.D.O. Tahsildars, S.I. Range Officers and Revenue Inspectors.

Incidentally I heard very curious story about this animal from the aborigines. They believe that when a sambar comes across a Pangolin it rears up on his hind legs and at the same moment the Pangolin rolls itself into a ball and then Sambar comes down —with all his weight on to the back of Pangolin—delivers blow after blow until the Sambar succeeds in dislodging a couple of bony scales.

As soon as this operation is over, the Sambar picks up the loose scales and swallows them.

In support of this story, the aborigines told me that, once the Pangolin is on his defensive (i.e. rolls up), you may strike dozens of blows with either butt end or sharp end of an axe it makes no impression on the animal. On the other hand, a Sambar on many occasions succeeds in killing the animal.'

EDITORS.

IV.—AN ALBINO SAMBAR.

Records of albino wild animals always have a certain amount of interest, so the following note is submitted.

In the course of an evening stroll in the mixed *sal* and chir pine forests at 1,500 ft. near Chaukhamb in the hills of the

Kohtri valley not far from Lansdowne, my wife and I saw a very conspicuous white object standing some 35 yards away and about the same number of feet below us. For a moment we thought we must be getting near a forest camp (we did not know the country), and that we were looking at the rear view of a white hill pony with phenomenally shortly docked tail; then that it was only a barkless bleached stump of that shape. But after the first moment, there was no question but that it was a sambhar hind standing with its back to us, with head turned to watch us through some thin scrub. We watched it with and without binoculars at the short range mentioned for as long as we wished, for, despite our movements, it did not stir. The muzzle was conspicuously pink and completely pigmentless as also were the fleshy parts round the eyes; the eyes also appeared pink, but we could not be absolutely certain of this; the ears with the light showing through them appeared possibly very slightly pigmented. Over the whole body the hair was definitely white, perhaps a bit dingy as though in need of grooming, as sambhar mostly look to be at this season, but impossible to describe as merely 'pale buff' or 'pale fawn'. It seems surprising that so conspicuous an animal could survive to maturity in forests with plenty of tiger and leopard, not to mention poachers.

Naini Tal, U.P.
April 1, 1938.

H. G. CHAMPION, I.F.S.,
Conservator of Forests,
Western Circle.

V.—THE MATING OF ELEPHANTS.

The manner in which elephants mate has long been a moot point. Owing perhaps to the position of the generative opening in the Cow it has been suggested that during congress she lies on her back—some have held that she digs a hole. The question if there yet remains any doubt as to the manner of fecundation may definitely be set at rest by the authentic photograph which I enclose.

The female was purchased on the 13th February 1936 being wild and just caught in a Khedda. Her age is about 30 years and height 7 ft. 6 in. The tusker is aged 35-36 having been in captivity for about 30 years, his height is 8 ft. 5 in. At the time the snap was taken the female had been partly broken in—she could carry a pad but did not know all the words of command. The pair had been brought in from the hills where they are let loose fettered and lead a semi-natural life often mixing with wild herds. The snap was taken from a distance of 60 yards in an open field with scores of villagers looking on. The tusker mounted about eight times, but the female did not respond as she kept crossing her hind legs. Subsequent to this the tusker mounted on several occasions, either in the compound or in the hills. The female is now in calf. The tusker has been getting musth for the last 5 years, the attack generally lasting from 10 days to a fortnight when he is unapproachable. The attack comes on usually in April or May. When in musth he always seeks the company of a female, and mounts whether she is willing or not. A point to be emphasised is that he was not musth when the photograph was taken.

COMILLA, TIPPERA,
E. BENGAL. PAUL DE LAUNEY.
April 11, 1938.

[We have not published the photograph submitted by the writer. There are a number of photos in existence which prove that elephants copulate in the position usual to quadrupeds. In the female elephant, the peculiar position of the female external generative opening, which hangs down in much the same position as the penis in the male, led to widespread doubts as to whether the act of copulation was performed in the position normal among quadrupeds. On plaques and in ancient Indian sculpture in which elephants are sometimes represented *in coitu*, the female is shown literally standing on her head. The weight and vigor of the male may force the female to go down on her fore knees and rest her forehead on the ground. Under sexual excitement the generative opening in the female is raised from its pendant position and assumes a situation more or less normal in quadrupeds. The alteration in position has been observed by ancient anatomists. Aristotle refers to it in his *Historia Animalium*. An interesting note in the *Oriental Sporting Magazine* indicates that the animals may at times take advantage of irregularities in the confirmation of the ground and so ease the burden of weight. In the note under reference the writer saw a pair of elephants mating. The female was standing in a dry nullah which was not more than five feet wide. The male rested his forefeet on either bank and so relieved the cow of the weight of his body.—EDS.].

VI.—A LARGE INDIAN ELEPHANT.

A Game Ranger on crop protection patrol shot a large tuskless male elephant last December in the Bhamo District of Upper Burma. The elephant which was a notorious man-killer, contained 8 ball shot from 12-bore guns, along one side (it was impossible to turn the elephant over to find out what was in the other side) and measured between pegs placed at the shoulder and the fore-feet, 10 ft. 8 in. It is probable that the effect of lying on its side, slightly increased the height measurement as recorded between the pegs but it would be interesting to learn whether larger Indian elephants than this are on record.

MAYMYO, BURMA. F. J. MUSTILL,
February 11, 1938. *Game Warden.*

[The highest recorded measurement of an Indian elephant is that of an animal from Ceylon which taped 10 ft. 8 in. at the shoulder (E. L. Walker, *Rowland Wards Records of Big Game.*

8th Edition). In the same book the record measurement from Burma is given as 10 ft. 6 in. (H. Shaw Dunn). In comparison the record African elephant is 11 ft. 6½ in. Extravagant estimates of the height of elephants have been recorded from time to time. Much amusing information is given in Sanderson's classic work, *Forty Years among the Wild Beasts of India.* Madras elephants were at one time said to be 17-20 ft. high while an animal at Dacca was said to be 14 ft. Sanderson went there to measure the monster which he found did not exceed 10 ft. Sanderson, who knew as much about elephants as any man is likely to know, was of opinion that an elephant measuring 10 ft. at the shoulder does not exist in India. The largest male he ever met measured 9 ft. 10 in. and the tallest female 8 ft. 5 in. Cingalese elephants according to Emerson Tennent seldom exceed 9 ft. According to Evans, another great authority on these beasts, 300 male elephants measured in Burma averaged 7 ft. 10½ in. at the shoulder, a group of females, 7 ft. 5¾ in. A merchant who had handled 2,000 of these animals, only had one that reached 9 ft. 4 in.—EDS.].

VII.—BEHAVIOUR OF GAUR OR INDIAN BISON.

With reference to Col. C. G. Toogood's note in the last *Journal* on the curious behaviour of Bison: Gaur are apt to behave strangely when concentrated on something which has aroused their excitement, *vide* my recent note on two bulls attacking a third fallen bull, while the cows stood around, in spite of the fact that the wounded bull had been fired at twice, and we were in full view within a few yards.

On another occasion a bull's attention was concentrated on a bear close to it. I shot the bear but the bison never moved for several minutes but stood staring at the dead bear, and finally walked slowly away.

HONNAMETTI ESTATE,
ATTIKAN, MYSORE P.O.,
S. INDIA.
January 16, 1938.

R. C. MORRIS.

VIII.—BEHAVIOUR OF GAUR OR INDIAN BISON (*BIBOS GAURUS*).

The note on tiger and bison on pages 852-53 of the December issue is interesting.

An incident in this connection occurred on 14th April last year, when I was walking at sunrise along a forest track in the Nilgiri-Wynaad.

I noticed a solitary bull bison (seen also on the previous day grazing in a swamp) about 50 yards up the slope above the road, standing at rest in thin tree jungle. I was in plain view but although the bull turned his head to stare at me more than once, he was not in the least alarmed. As I watched him through my glasses, he slowly lowered his head and gave a deliberate long-drawn snort at the long grass a few paces in front—whence I heard a continuous cracking, culminating a few seconds later in a fine tiger striding slowly out on to the road side fire line, eighteen paces from me. The bison did not change his stance or seem in any way alarmed, though in the confusion consequent on my shooting the tiger, he of course, vanished.

The point is the entire absence of alarm shown by the bison regarding both myself, my tracker, and the tiger, and my own small experiences are to the effect that bison have not shown shyness at least when seeing or hearing man.

On 17th May, last year, Major E. G. Phythian-Adams and I were in the same locality after one of the local rogue elephants (which we shot the same day). Early in the morning we found a bull bison with a small head grazing in bush jungle alongside a wide open grass track. On our approach within 50 yards (there was practically no wind) the bull walked out into the middle of the path and came towards us, head up and snorting—he appeared so truculent that I turned over my safety-catch. We walked towards him and at less than 30 paces, he appeared to recognize us and the trackers as men and galloped off. Again in 1936, while staying with Mr. R. C. Morris, I found a fine bull on the Mysore-Coimbatore boundary, and although I was quite exposed in waist-high grass, the bull could not apparently make me out at 70 paces, and walked off slowly into the forest. From curiosity I followed him, and noted that he halted several times at 30 paces or so to stare at my tracker and myself.

I have had several similar experiences, notably in Coorg, many years ago. On one occasion a bull and I were face to face for many minutes in forest, so close that I could watch the flies walking on his face. Again one old grey bull (with a row of mynahs sitting on his back) did not even raise his head from grazing in a swamp as we pushed through the noisy grass close to him, only an hour after firing several shots from a ·470 cordite less than a mile away.

Mr. R. C. Morris's opinion and experiences on this question would be interesting. It almost appears as if bison on many occasions cannot fully recognize men moving in the open at over 50 yards.

51 Ross Keppel Line,
Peshawar Cantt.
February 7, 1938.

H. G. ROSSEL,
Major.

IX.—THE USE OF FIREWORK OR ROCKET CARTRIDGES IN THE PROTECTION OF CROPS.

I have read with interest the article on page 855 of your December 1937 issue, entitled 'The Use of Firework or Rocket Cartridges in the Protection of Crops'. In Burma we tried out similar cartridges during 1935 and 1936 but with little success. This was attributed to the fact that crop raiding elephants in many parts of the country had become accustomed to villagers attempting to drive off the crop raiders by exploding green bamboos and throwing flares, etc. A further difficulty was experienced owing to the fact that a lot of paddy field raiding takes place during the rains and the damp atmosphere adversely affected the cartridges. Maroons, thrown by hand were also tried out, but as this involved approaching the elephants to within 50 yards and lighting the maroon with a match, generally at night, little success attended these efforts. Wild elephants are now being controlled under a definite scheme, which consists briefly in extermination where the forest is unsuitable for retaining the elephants and confining the remainder to large areas of forest where conditions are more suitable. Extermination is being done by a combination of kheddahs and armed Game Rangers, but it is also necessary to post armed Game Rangers round parts of the permanent blocks where crop raiding occurs. There is now some evidence that crop raiders are realising the dangers which attend their visits to cultivation and it may be possible in the near future to try out fire-work cartridges once more. For this reason I should be grateful if Mr. Morris would send me the name of the German firm which manufactured the cartridges used by him. No one regards with favour the wholesale slaughter of wild elephants but in 1935 the elephant population in Burma was conservatively placed at 10,000 animals and during that year only 45 animals were captured. Under the present scheme it is expected that the elephant population will be reduced by 3,000 animals, leaving a stock of about 7,000 animals.

MAYMYO, BURMA. F. J. MUSTILL,
February 11, 1938. *Game Warden.*

X.—THE YELLOW-BELLIED FLYCATCHER (*CHELIDORYNX HYPOXANTHUM*): AN EXTENSION OF ITS RANGE.

I shall be glad if you can kindly tell me whether you have *Chelidorynx hypoxanthum*, the Yellow-bellied Flycatcher, noted for this district (in winter only). I saw a pair of these birds in a wood about 8 miles along the Jammu road in the first week in March 1936. Last year I was at Home, so did not have any opportunity of observing them. But this month I have again seen two or three of these birds at places between here and Jammu. I see from the old *Fauna* that they do not appear to be noted west of Simla, but possibly the new edition of the *Fauna*, of which I have no copy, may give further information. As I was on two occasions able to get within a few feet of the bird (which was hawking from a small bush) and examine it very thoroughly through my glasses, there can be no doubt about the identity of the species.

SIALKOT, PUNJAB. E. A. STORRS FOX.
February 13, 1938.

XI.—THE STATUS OF THE KOEL (*EUDYNAMIS SCOLOPACEUS* L.) IN SIND.

Since writing the article on this subject, which appeared in Vol. xxxix, No. 2, of the Society's *Journal*, dated the 15th April 1937, I had occasion to visit Shikarpur in June last after a lapse of several years.

I was in Shikarpur from the 4th to the 8th June 1937 and found that the Koel had continued its movement north and arrived there. I heard several Koel call repeatedly on the early morning of the 5th. The day following I paid a flying visit to the mango *topes* and gardens round about the town and both heard and saw several birds, both male and female, in the short time that I had at my disposal.

From the 6th to the 8th, the date of my departure, I heard birds calling daily, early mornings, and a pair daily visited some fig trees in the Rest House garden, where I often saw them at very close range.

Purbia *malis* and others in the P.W.D. garden, Shahi Bagh and other gardens told me that the Koel had made its first appearance in Shikarpur only two summers previously (1935) and that it had been there regularly every summer since.

As the Crows had not then commenced their domestic affairs I was unable to obtain first-hand knowledge of its breeding in Shikarpur, but a Purbia *mali* in Shahi Bagh told me that the year before (1936) he had seen a pair of crows feeding a young Koel which was just able to fly. I have no reason to doubt this information as the Purbia of the U.P. knows the Koel only too well.

KARACHI. K. R. EATES,
January 27, 1938. F.Z.S., M.B.O.U.

XII.—SOME INTERESTING RECORDS OF BIRDS IN THE PUNJAB. A CORRECTION.

In my note under the above heading on page 861 of vol. xxxix it was stated that ♂ ♀ *Chrysocolaptes guttacristatus sultaneus* were obtained on 24th and 26th February, 1936. I have now been informed by Mr. Hugh Whistler that, by an oversight, the ♀ was wrongly identified. It is *Dinopicum shorei* (Gould,) the

Himalayan Golden-backed Three-toed Woodpecker, which also is new to the Punjab List.

RAWALPINDI,
PUNJAB.
April 3, 1938.

H. W. WAITE, M.B.O.U.,
Indian Police.

XIII.—CUCKOO PROBLEMS.

It is already April and so rather late to ask for the following observations to be carried out this year, but I am going to make a start myself and I would ask for co-operation from all those interested in the cuckoo.

It is desirable to find out what are the reactions exactly, if any, betrayed by those species of small birds that habitually foster the cuckoo, when they find a strange egg in their nest.

I suggest that a light bamboo hide be constructed which is easily portable. This can be set up near such nests and observations can be carried out from it.

A suitable egg must be chosen for the experiments. It should be either a cuckoo's egg, or some other bird's egg about the size of a cuckoo's egg, and the *greater the contrast* between it and the eggs of the nest-owner the better. I am starting with a bulbul's egg on which I have painted a startling, wide zone of white—in white enamelled paint. This is in violent contrast to the eggs of the Burmese Stone Chat and Blyth's Pipit—species of common fosterers I am experimenting on this year.

Some authorities on the cuckoo maintain that the nest-owners frequently 'eject' cuckoo's eggs which contrast too violently with their own. They do not suggest how this feat is accomplished and *have not as yet proved that it takes place.* They are however convinced that it does happen. On the face of it it would appear to be physically impossible for such small birds to remove a cuckoo's egg from their nests unless they first broke the egg in their nest and then carried off the fragments in their bill.

To try and clear up this little problem I have suggested that experiments be conducted as I have described. These experiments must be of course carefully recorded in a note-book and the data published in due course when a sufficient number of experiments have been carried out.

To avoid unnecessary bother in waiting in the hide I suggest that the hide be set up and left unoccupied for a few hours till the nest-owners are used to it. If it is then occupied the birds will return at once to their nest and the observation can then be made in the least possible time. Many hundreds of such observations are necessary before we can form an opinion, but these observations are quick and easy enough to conduct and should afford interest, if not amusement, while they are being carried out, and so I hope those interested in the cuckoo will help and later record with full data the results of their experiments.

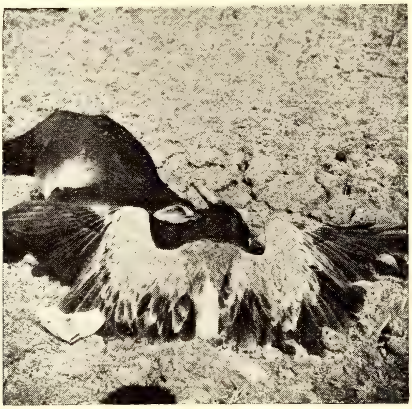
Taunggyi, S. Shan States,
Burma.
April 7, 1938.

T. R. LIVESEY.

XIV.—STRANGE ACCIDENT TO A VULTURE.

(*With a photo*).

A young friend of mine took three photos of a vulture which attacked a dying calf a few miles out of Bombay but apparently was too venturesome and was caught by the head in the calf's mouth. Both were found dead together. He wants to know if it is a common occurrence.



21, Ravelin Street,
Bombay.
March 16, 1938.

J. A. C. GREENWOOD.

[Most unusual we believe.—Eds.].

XV.—OCCURRENCE OF THE LESSER ORANGE-BREASTED GREEN PIGEON (*DENDROPHASA BICINCTA BICINCTA*) AT KEAMARI, SIND.

On the 3rd January 1938 a Green Pigeon was shot at Keamari by D. Lyons, son of Lieut. G. Lyons, R.I.A.S.C.

The bird, thanks to Major W. J. Dixie, R.I.A.S.C., was brought to me by Lieut. Lyons himself the same day for identification and proved to be an adult female of the species named above. The bird was very fat and its plumage was in perfect condition.

It was obviously no 'escape'. The crop contained a number of freshly eaten pipal berries. The pigeon when shot was seated at the top of a pipal tree. The young shikari, who was using a ·22 air gun, did not think at the time of looking carefully in the tree for other birds but says that a couple of days later he saw another bird in Keamari sitting at the top of a pipal tree.

About the 4th or 5th, yet another Green Pigeon, species not known, was seen seated at the top of a leafy tree in Karachi by a lady. So far as I am aware no others came to notice.

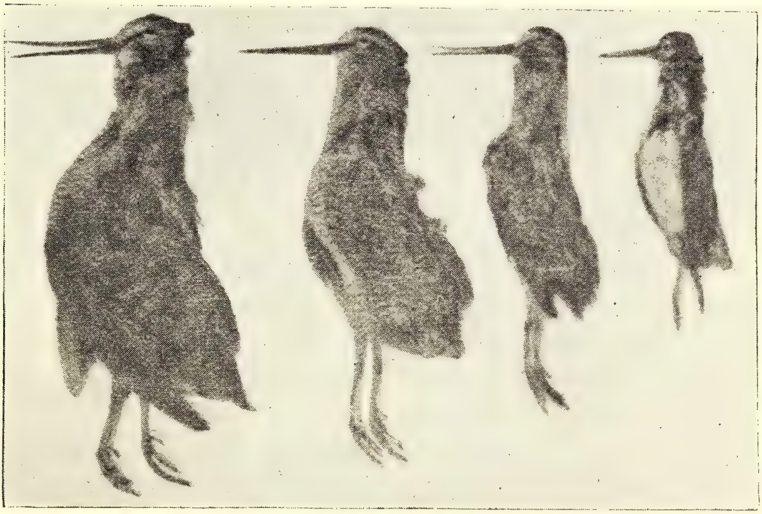
The Society very kindly examined the skin of the bird shot by young Lyons at Keamari and informed me that it had been correctly identified as *Dendrophasa bicincta bicincta.*

Regarding its occurrence in Sind the Society writes, 'With regard to its distribution we can find no reference to its occurring so far west as Karachi. The *Fauna* gives its north-western distribution as follows:—'Northern India from the United Provinces along the Terai through the foot hills and adjoining plains to Eastern Assam, north of the Brahmaputra; Bengal and Bihar, but replaced in the extreme east by *praetermissa.*

It is difficult to ascribe any real reason for its occurrence at Karachi, but it is quite possible that the bird may have been driven southwards by the prevalent cold wave.'

KARACHI. K. R. EATES,
February 2, 1938. F.Z.S., M.B.O.U.

XVI.—WOODCOCK, WOOD SNIPE, PINTAIL SNIPE AND JACK SNIPE IN ONE DAY!



The enclosed photograph may be of some interest, as showing the relative sizes of Woodcock, Wood Snipe, Pintail Snipe and Jack Snipe. The respective weights were $11\frac{5}{8}$, $5\frac{1}{2}$, $4\frac{3}{4}$ and 2 oz.

It is very doubtful if all four species have ever been shot on the same day on these hills, prior to this. They were shot by me on the 16th February 1938, not very far from Ootacamund.

'Lansdown', Ootacamund.
March 25, 1938. R. F. STONEY.

XVII.—THE SNIPE-BILLED GODWIT [*LIMNODROMUS TACZANOWSKIUS* (VERREAUX)] IN ORISSA.

The head and legs of a Snipe-Billed Godwit were sent to the Society by Mr. R. S. Clough. The bird was shot at the Chilka Lake, Orissa, in December 1937. There are a few previous records of the occurrence of this winter migrant within Indian limits. But as Mr. Stuart Baker indicates it doubtless occurs far more often than it is recognised and shot.

Bombay. S. H. PRATER.
May 31, 1938.

XVIII.—THE OCCURRENCE OF THE TURNSTONE, THE RED-NECKED PHALAROPE, THE FALCATED TEAL AND THE SHELDRAKE AT PATNA.

On 23rd September 1937 a young male Turnstone (*Arenaria interpres* L.) was brought to me by a local bird-catcher who declared it was trapped on a Jheel in the outskirts of the town. It had a wing measurement of 149 mm. The same man also brought me on 6th November 1937 a female Red-necked Phalarope in winter plumage. Its legs were black but the lobes of the web between the inner and middle toes were bright orange and the tibia was pale orange.

An adult male Falcated Teal (*Eunetta falcata* Georgi.) was also brought to me on the 30th January 1938 being trapped along with Widgeons and Shovellers. The Sheldrake (*Tadorna tadorna* L.) is a rare visitor to these parts. Thirty years ago I once noticed a solitary bird on the Ganges which would not let me get within range though it could be distinctly identified through glasses. Last year, in December, I noticed a small flock and again came across a flock of eight birds on 5th January 1938 which were probably the same birds. Two attempts were made to get within range but they were too shy and would not let me get anywhere within range.

Patna. E. A. D'ABREU.
February 10, 1938.

XIX.—BEWICK'S SWAN (*CYGNUS BEWICKII* YARRELL) NEAR DELHI.

I enclose a snap of myself holding up a bird shot on the 26th instant by Mr. R. E. Grant Govan of Delhi at Sutana about 45 miles north of Delhi.

There seems to me to be little doubt that it is a Bewick's Swan (*C. bewickii*). The upper part of the beak upto the eye was yellowish and the beak and legs jet black. Other particulars are neck 2 ft. long, spread 6 ft. 6 in., base of neck to tip of tail 2 ft., legs 1 ft. 6 in. The bird appeared to be slightly immature for though the feathers were white, there were a few slightly greyish feathers on the neck and wings.

It was sitting in a piece of water about 2 ft. deep and 100 x 300 yds. in extent. The water or jhor was not far from a village. It was clear in the centre with the ordinary reeds and a few weeds near the edges. When shot the bird was alone and appeared on the whole to be confiding. The Manager of the Manton's, to whom this bird was given, intends to preserve the skin and send it to Bombay.

There appears to be no previous record of Swan near Delhi and perhaps some of your other readers would be interested to see this and possibly supply useful information.

DELHI. E. S. LEWIS.

December 29, 1937.

[The bird was sent to the Society's Museum. It is an example of Bewick's Swan (*Cygnus bewickii* Yarrell). There are two previous records of the occurrence of this swan within Indian limits. One is a specimen shot at Jacobabad, Sind, by Mr. B. L. McCulloch on the 2nd December 1907, and the second is a female shot by Captain P. C. Elliot-Lockhart near Mandan, N.-W.F.P., on the 30th December 1910. Both these specimens are in the Society's collection.—EDS.].

XX.—OCCURRENCE OF THE LONG-TAILED DUCK (*CLANGULA HYEMALIS* LINN.) NEAR QUETTA.

Perhaps it may interest your Society to know that a female specimen of the Long-tailed Duck in full plumage was shot on Khush Dil Khan Lake, 40 miles from here on the 2nd January 1938. A flight of about 6 have been observed in the lake. I believe this variety must be very rare in India. Their home is near the Arctic Circle.

This year very many more Red-headed Pochard have been shot than formerly.

On 16th January a male and female Smew were shot. They too are uncommon up here.

STATION STAFF OFFICE,
QUETTA.
M. B. P. REEVE,
January 21, 1938.
Major.

[This is the fourth recorded instance of the occurrence of this duck within Indian limits since the publication of the record of the specimen shot by Capt. A. E. L. Dredge at Chaman, Baluchistan, in October 1933 (*J.B.N.H.S.*, vol. xxxvii, p. 549).—EDS.].

XXI.—SHELDRAKE (*TADORNA TADORNA* LINN.) IN ORISSA.

Since I wrote to you on the 17th December a friend of mine here has been down to the Chilka Lake and tells me that he saw hundreds of Sheldrake (*Tadorna tadorna* Linn.) there; one of which he shot to show to the boatmen, as they were unfamiliar with the species. This seems to be a particularly interesting record in view of the fact given recording the distribution of this duck by Stuart Baker in *Indian Ducks and Their Allies* and subsequently in the *New Fauna*, vol. vi. Chilka Lake is, as you know, 320 miles south of Calcutta.

1, CLIVE STREET,
CALCUTTA.
R. J. CLOUGH.
January 1, 1938.

XXII.—A HYBRID: COMMON TEAL AND BAIKAL TEAL.

I do not know whether the following note is of any interest.

When shooting Duck on the Mirgund Reserve in the main Kashmir Valley, I shot an unusual duck. It was in general appearance rather like a drake Teal, but much larger and heavier. It had two markedly pointed tail feathers. It weighed 1 lb. 4 oz. It was flying in company with ordinary Teal. Date, 29-12-37.

It was skinned by Mr. F. Ludlow and sent to the British Museum (Natural History) for identification.

I have since heard that it is unlike any bird that they had previously received and after a number of people had looked at it, it was decided that it was a cross between a common Teal (*Nettion creca*) and a Baikal Teal (*N. formosum*). The visits of the Baikal Teal to India are extremely rare.

THE RESIDENCY, KASHMIR,
SRINAGAR.
J. W. THOMSON GLOVER.
April 1938.

XXIII.—MIGRATION OF WILD FOWL.

(*Continued from vol.* xxxviii, *p.* 833).

Place of Ringing	No.	Date of Ringing	Species	Ringed by	Place of Recovery	Date of Recovery
Bhulpinder, Sagur, Patiala State, Punjab.	3624	30– 3–1929	Shoveller ♂ (*S. clypeata*)	W. H. Hutton	Kzyl-Orda (approx. 40°45′ N, 65°30′ E.	March 1929
Gajja, Bhawalpur State, Punjab	2165	12–12–1928	Mallard ♂ (*A. platyryncha*)	G. Atkinson	Volchikhino, Slavgorod. (52°20′ N, 79°20′ E.	May 1929
Manchar Lake, Sind ...	2784	26– 1–1929	Gadwall (*C. streperus*)	B. B. Maclachlan.	Novo-Voznessenskaja near Tatarsk. (55°20′ N, 76°E	October, 8th 1930.

EDITORS.

BOMBAY.
May 30, 1938.

XXIV.—THE FOOD OF THE MUGGER (*CROCODILUS PALUSTRIS*).

With reference to Mr. McCann's note on the crocodiles of Powai Lake feeding on beetles (which habit I have independently confirmed), I am informed by a usually reliable local authority, that these 'degenerate' animals feed on the fallen fruit of the 'Oomber'. (*Ficus glomerata*).

Andheri. HUMAYUN ABDULALI.
November 25, 1937.

XXV.—THE HEAD SHIELDS OF THE HAMADRYAD [*NAIA HANNAH* (CANTOR)]: AN ABNORMAL EXAMPLE.

I append a drawing of the head of the King Cobra [*Naia hannah* (Cantor)] I shot in 1936 showing a peculiar characteristic in the form of a small scale imposed between the parietals and the two occipital shields as shown shanked in the sketch.

After a perusal of various works on Indian snakes I find that this feature is not noted or illustrated in drawings of this snake's head. I therefore conclude that it must be a variation from the normal with this particular specimen. Another feature is the divided left-hand occipital, the left lobe having the appearance of a body scale, also the unequal size of the temporals from each other on either side.

It will also be seen that the right parietal has a kink in the side. I note that Wall mentions in his 'Poisonous Terrestrial Snakes' that he has never seen a ...... scale in the Hamadryad. Two exist on either side of the lower jaw of this specimen.

Naduar Estate,
Valparai P.O., R. N. CHAMPION-JONES.
S. India.
March 1, 1938.

[The snake described by the author is an aberrant specimen. None of the Hamadryads in our collection show the characters indicated.—Eds.].

XXVI.—TWO CATERPILLARS OF ECONOMIC IMPORTANCE NOT RECORDED BEFORE FROM S. INDIA.[1]

At the previous session of the Congress the author submitted a paper on the cultivation of the *Koorkan* plant (*Coleus parviflora*), as a vegetable crop in Malabar, and in that paper a passing reference was made to two leaf-eating caterpillars causing some damage to the crop. Further studies were since made on these two insects and in this short paper an attempt is made to present the data collected, on the bionomics of these insects and their proper identification. There is no previous record of these insects as pests from any part of India. The insects have been identified as (1) *Pycnarmon cribrata* F. and (2) *Phostria piasusalis* W. both belonging to the family *Pyralidae*.

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[1] Paper read at the Indian Science Congress, Calcutta, 1938.

PYCNARMON CRIBRATA F.

The adult insect is a medium-sized moth with the cream white wings, speckled with brownish patches. It is similar in appearance to *P. jaguaralis* G. Though nine species of the genus *Pycnarmon* (*Aripana* of Moore) are recorded by Hampson in his *Fauna* volume this species is not one of them.

The life history of the moth is passed on the *Coleus* plant itself. The eggs are laid on the tender leaves and the caterpillar feeds from inside a longitudinally folded leaf. The two lateral halves of the leaf are brought over and folded inwards and having eaten the leaf it folds another and feeds from inside of this sheath. A full-grown caterpillar reaches an inch in length. It is slender and elongated and slightly compressed dorsoventrally. General colour is olive green above and paler below. Head pale brown; prothorax dark grey, all the body segments from behind the prothorax have each a transverse row of shining black tubercular spots each giving rise to a pale white set; while on the meso- and metathoracic segments there are two such black spots on each side of the middorsal line, all the abdominal segments have only one on each side of the middorsal line. All these segments have also a lateral smaller black spot on each side. The legs are grey and the pro-legs transparent green. The pupa is reddish brown and is found inside the leaf fold itself. The pupation period occupies ten to twelve days.

PHOSTRIA PIASUSALIS W.

This caterpillar, though a leaf feeder, exhibits a slightly different habit. Instead of folding a single leaf longitudinally like *Pycnarmon* this larva selects the top shoot leaves of the plants and webs them together and remains feeding inside this fold made of more than one leaf. In general coloration the caterpillar of *Phostria* is pale green uniformly and has no series of black spots. The moth also has sombre pale brownish wings with no conspicuous spots. No species of *Phostria* is recorded by Hampson in his fauna volume.

During the breeding of these moths, the leaf folder caterpillar *Pycnarmon* was found heavily parasitised in the fields by a small stout built braconid wasp *Microgaster psarae* W. previously recorded as parasitic on the brinjal leaf webber *Psara bipunctalis* F. in Malaya. The parasitic cocoons are pure white in colour and the parasite is a small shining red and black active insect measuring about 1/6 in. in length. It appears possible that this parasite plays the part of a fairly efficient natural enemy of the pest.

MADRAS. T. V. RAMAKRISHNA AYYAR, B.A., Ph.D.,
Government Entomologist (Retd.).

XXVII.—NOTES ON THE EARWIG (*DICRANA KALLIPYGA* DOHRN.).

Original specimen, ♀, caught in room at night, 28-11-37. When kept under observation was seen to feed on small insects, such as small grasshoppers, soft caterpillars, etc., by seizing them with the forceps, which are used for this purpose with as much dexterity as the callipers of a crab. The abdomen is then flexed and rotated to enable the object held in the forceps to be readily eaten by the earwig. Sometimes the victim is firmly held in the forceps for some time before feeding operations begin. The face of the insect is often eaten first, and the grip may be shifted from time to time to facilitate feeding; when only part of the meal remains the grip may be relaxed and the remains eaten without the help of the forceps. In the case of small and helpless insects also seizure may be effected directly by the mouth parts. When hungry, small insects may be pursued energetically and seized with the forceps with great dexterity. On one occasion when another specimen of the same species was placed in the tin it was bitten in half and the thorax and abdomen sucked empty.

On December 26th sixty-four eggs were found to have been laid on pieces of bark and moss. These have not yet hatched out and may be infertile. Oviposition was not witnessed. The eggs are oval, dull white, and are neatly stuck by one end to a flat surface.

So far this specimen has been kept alone and it feeds regularly on small grasshoppers.

Four new specimens; two ♂ and two ♀. These were found under the bark of eucalyptus trees after rain. They are of the same species as the above and this appears to be the common species up here; I have so far only found one other species living in similar places. These specimens feed in the way already described and are very aggressive, threatening each other and sparring with their forceps and when possible seizing each other; but opposite sexes treat each other in a much more friendly way. The males are readily distinguished from the females by their comparatively smaller abdomen and by the appearance of the last dorsal segment, which is very broad and produced laterally into strong crested folds; in the male also the penultimate ventral segment is broad and rounded, while in the female it is triangular and rounded at the apex. The male forceps is also distinctive, being stouter and more aggressive looking. The average length of the body appears to be about 20 mm. and the forceps 5 mm. The two female specimens are definitely larger than the males.

Reproduction.—The two couples have been seen *in coitu* on various occasions, the penultimate ventral segment of the ♂ being apposed to that of the ♀ and remaining attached in this position for several hours. The ♂ has usually to rotate its posterior half of the abdomen for this purpose, while the front part of the body usually remains unrotated. The act of copulation is preceded by the stroking and tapping of the dorsal surface of the terminal segments of the ♀, and the ♂ finally insinuates its forceps under the penultimate ventral segment of the ♀.

28-1-38. Twenty-four eggs were found stuck to the side of the bottle, and two days later fifteen additional eggs had been laid in the same place. On the 1st and 3rd of February a couple was seen 'in coitu' for several hours.

Though powerfully attracted by bright light at night, these specimens appear to have poor vision, but very acute sense of touch. They spend a good deal of time on their toilet, the antennae, the feet, the forceps and other parts of the body being severally cleansed during moments of leisure by drawing the part through the mouth organs in order to remove excessive moisture, dust, etc.

My specimens tally well with the description of *Dicrana kallipyga* given in the *Fauna*. There are certain differences. The head is not brick-red but blackish brown; the ♀ is definitely larger than the ♂ particularly as regards the abdomen.

AUCHINDOON, SIR FRANK CONNOR,
OOTACAMUND. *Major-General,*
February 3, 1938. D.S.O., F.R.C.S., I.M.S.

[A previous note on the function of the 'Forceps' in the Earwigs (*Forficulidae*) written by Sir Frank Connor was published in vol. xxvi, p. 688. It refers to a specimen taken by him at Amara in Mesopotamia in 1918 and subsequently associated by Mr. P. A. Buxton with *Labidura riparia* (*J.B.N.H.S.*, vol. xxvii, p. 963). In the introduction to the Volume on Dermaptera (Earwigs) in the *Fauna* series, Mr. Malcolm Burr refers to the use of the forceps by these insects as weapons of offence and defence. They are not used in copulation but, as the present note indicates, may be used for holding the food and conveying it to the mouth. Occasionally they are used to fold and unfold the wings and lift up the wing cases or elytra.—EDS.].

PROCEEDINGS OF THE ANNUAL GENERAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of Members of the Bombay Natural History Society was held on Thursday the 24th March, 1938, at 6-15 p.m. in the Prince of Wales' Museum (New Wing), Rev. Fr. J. F. Caius, S.J. presiding.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.

The Honorary Secretary announced the election of the following 28 new members since the last meeting held on 25th August 1937:—

Mr. G. R. Nicolaus, F.R.G.S., F.Z.S., London; Mr. Mohamed Etzad, Rasul of Jehangirabad Raj, Colvin Taluqdars College, Lucknow; Mr. Ravendra Ramanuj Singh, I.M. Academy, Premnagar, Dehra Dun; H. E. Sir Roger Lumley, G.C.I.E., D.L., Bombay; Mr. Charles A. Osborn, Bombay; Mr. E. T. Osborne, Kirkee; Capt. P. M. McSwiney, I.M.S., Muttra; G. D. Lake Esq., England; Mrs. W. L. Clements, Bombay; Mr. A. J. E. Howey, England; H. H. Maharaja Shri Vijaysinhji of Rajpipla; Dr. H. J. Slocum, U.S.A.; The Superintendent, State Museum & Zoo, Trichur; Mr. P. G. Burder, Jubbulpore, C.P.; Capt. F. L. Roberts, Loralai; The Mess Secretary, Officers' Combined Mess, The Burma Rifles, Maymyo, Burma; Mr. C. P. J. De Haas, Java; Mr. W. E. Popple, Bombay; Mr. D. J. Emerson, Malabar; Mr. A. D. Vincent, Mundakayam, S.I.; The Director of Agriculture, Baghdad, Iraq; Mr. G. E. Turnbull, B.F.S., Rangoon; Mr. Carr A. Martin, Rangoon; The Business Manager, Marine Biological Laboratory Library, Woods Hole, Mass., U.S.A.; Mr. R. C. Jackman, Fort Sandeman; Capt. F. G. Anderson, Calcutta; Mr. J. A. C. Greenwood, F.R.En.V. Soc., Bombay; and Mr. A. de B. Adam, Jubbulpore, C.P.

BOMBAY NATURAL HISTORY SOCIETY.

Office Bearers—1938.

Patron.—H. E. The Viceroy of India.

Vice-Patrons.—H. H. The Maharaja of Travancore, G.C.I.E.; H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; H. H. The Maharaja of Jodhpur, G.C.I.E., K.C.S.I., K.C.V.O.; H. H. The Maharaja of Rewa, K.C.S.I.; H. H. The Maharaja of Bhavnagar; H. H. The Nawab of Junagadh, G.C.I.E., K.C.S.I.; Sir David Ezra, KT., F.Z.S.; F. V. Evans, Esq.; A. S. Vernay, Esq.; Lt.-Col. K. G. Gharpurey, I.M.S. (Retd).

The following gentlemen were elected to serve on the Managing Committee for the ensuing year:—

President.—H. E. Sir Lawrence Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Father J. F. Caius, S.J., F.L.S.; and Rt. Rev. R. D. Acland, M.A.

Executive Committee.—Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, M.L.A.; Mr. M. J. Hackney; Mr. D. G. Hill; Mr. H. L. Shoveller; Lt.-Col. W. C. Spackman, I.M.S.; Lt.-Col. S. S. Sokhey, I.M.S.; Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P.; Mr. F. Wadia; Mr. P. M. D. Sanderson, F.Z.S. (*Honorary Secretary*); Mr. H. M. McGusty (*Honorary Treasurer*).

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S.; Lt.-Col. R. W. Burton, I.A. (Retd.); Mr. C. H. Donald, F.Z.S.; Dr. F. H. Gravely, D.SC.; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S.; Mr. R. C. Morris, F.R.G.S., F.Z.S.; Major E. G. Phythian-Adams, F.Z.S., I.A. (Retd.); Dr. Baini Prashad, D.SC.; Mr. H. C. Smith, I.F.S.; Lt.-Col. C. G. Toogood, C.I.E., D.S.O.; Mr. J. H. Williams.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER 1937.

ADMINISTRATION.

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Fr. J. F. Caius, S.J., F.L.S.; Rt. Revd. R. D. Acland, M.A.

Executive Committee.—Mr. H. D. Ash; Mr. Farrokh E. Bharucha; Sir Alwyn Ezra, KT., F.R.G.S., F.Z.S.; Mr. A. Forrington; Mr. C. G. Freke, C.I.E., I.C.S.; Mr. J. B. Greaves, M.L.A.; Mr. D. G. Hill; Lt.-Col. S. S. Sokhey, I.M.S.; Lt.-Col. C. G. Toogood, D.S.O.; Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P.; Mr. P. M. Sanderson, F.Z.S. (*Honorary Secretary*); Mr. H. M. McGusty (*Honorary Treasurer*), Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.SC., Madras; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian-Adams, I.A. (Retd.), Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Maymyo; Mr. F. Wadia, Poona; Mr. J. Williams, Coimbatore.

Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); C. McCann, F.L.S. (*Assistant Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1937.

The Society's Journal.—Three parts of Volume XXXIX of the Journal were published during the year.

MAMMALS.

Mongooses of British India.—Mr. Pocock's paper is based mainly on the collections made by the Society's Mammal Survey and on such material as was available at the British Museum. The Survey material was previously reported on in the *Journal* by Messrs. Oldfield Thomas and Wroughton. Pocock agrees with the view accepted by both Thomas and Wroughton that the Brown Mongoose of Ceylon, hitherto recognised as a distinct species under the name *Herpestes fulvescens*, is a race of the Brown Mongoose (*H. fuscus*) of the South Indian hill ranges. The author disagrees with Wroughton's recognition of the Small Nepal Mongoose (*H. nepalensis*) and the Ceylon Mongoose (*H. lanka*) as distinct species, and regards the former as a racial form of the Small Indian Mongoose (*H. javanicus auropunctatus*), and the latter, of the Common Indian Mongoose (*H. edwardsi*). The author thus reduces the total number of species occurring in British India to six. A reduction is also made in the number of sub-species.

Wroughton, Thomas and Miss Riley, from their study of the splendid material provided by the Survey, differentiated a number of races which cannot be recognised as such. The variations indicated in many of these so-called sub-species may be attributed to changes in coat and colour due to season. The author gives reasons for his conclusions and, following the methods adopted in his previous papers on Indian Carnivora, gives detailed descriptions of the individual species examined by him.

Measurements of Tigers.—Mr. G. H. L. Marshall publishes records of tigers shot by him in the Naga Hills, Assam. Out of a total of 59 animals (27 tigers and 32 tigresses) the average length of 18 full grown males is 8 ft. 7 in. and of 25 full grown females, 7 ft. 9 in. Only one tiger exceeded 9 ft. It taped 9 ft. 6 in. and was exceptional. Mr. Marshall suggests that the tigers of the Naga Hills are definitely smaller than those recorded from other areas in India. It would be interesting to obtain similar data from other parts of India. We have Sir John Hewett's record of tigers shot by him in Garhwal and Naini Tal. Eight males ranged between 10 ft. ½ in. and 10 ft. 5½ in., while seven females were between 9 ft. and 9 ft. 3 in. Unfortunately Sir John's records from Naini Tal and Garhwal all relate to large animals. We do not know whether smaller animals were shot by him in this area and have therefore no means of arriving at a conclusion regarding the average size of tigers in Garhwal. Average measurements, arrived at from records such as Mr. Marshall has kept, if obtained from different provinces, will help us to arrive at more definite conclusions regarding the size attained by tigers in different parts of the country.

Man-eating Hyaenas in the United Provinces.—Reports have appeared from time to time in the press of Hyaenas attacking human beings in the United Provinces. Investigations made by the Society through responsible district officers revealed two instances in which children were reported to have been killed by hyaenas and one authentic case in which the hyaena was actually seen carrying off a child which was subsequently rescued. Hunger induced by shortage of the natural food may have been the contributory cause. It is suggested that man-eating, once established in an individual, may become a tradition passed on from a mother to her offspring; hence attacks on human beings may recur within a particular area over a number of years, till the particular stock which has acquired this trait has been exterminated.

BIRDS.

Scientific Surveys.

Vernay Scientific Survey of the Eastern Ghats.—With the publication of parts XV and XVI dealing with the waders and ducks, Messrs. Whistler and Kinnear bring to a close their reports on the Eastern Ghats Survey which commenced in the year 1933. The survey of this area, undertaken in the year 1929-30, was made possible by the generous assistance of Mr. A. S. Vernay who contributed a sum of Rs. 14,300 towards the expenses. 1,777 birds and 1,621 mammals were collected in the districts traversed by the Eastern Ghats. The mammal collections were reported on by Mr. Pocock and Mr. Fry, and the bird collections by Messrs. Whistler and Kinnear. Previous to this survey, little was known of the Ornithology of the Madras Presidency; while, as regards mammals, the Eastern Ghats area had not been worked by the Mammal Survey. The ornithological reports on the results of the survey have been written in the form of an account of the Birds of the Madras Presidency. The reports include all the species hitherto recorded from the Madras Presidency, whether collected by the Survey or not and thus provide an up-to-date account of the avifauna of the Province. Apart from this, the authors have dealt with each species from the standpoint of its general distribution within the boundaries of British India, supplementing and frequently correcting the data recorded in the new *Fauna*. The work thus provides us with more precise knowledge of the range and movements of various species. Further, by meticulous labour and research they have helped to unravel the existing confusion in the nomenclature of many species and, from a careful study of all published records and of the collections made available by the survey and through other sources, they have been able in many instances to revise what has hitherto been recorded regarding the geographical races of species dealt with.

Ornithologists in India owe a deep debt of gratitude to Mr. A. S. Vernay whose generosity made this survey possible and to Mr. H. Whistler and Mr. N. B. Kinnear for their labours. The painstaking thoroughness and the care that they have devoted to the preparation of the report have made the work the most important contribution to Indian Ornithology of recent years.

Surveys of Travancore and Cochin.—These surveys were undertaken on behalf of the Society by Mr. Salim A. Ali in the year 1933, to link up with surveys made in the Eastern Ghats and Hyderabad State. The expenses were met by grants made by the States for this purpose. The material obtained was reported on by Mr. Salim A. Ali, assisted by Mr. H. Whistler. Publication commenced in 1935; and with the issue of parts VII and VIII during the year the series has been concluded. What was known previously of the ornithology of Travancore was based mainly on the papers written many years ago by Hume and Fergusson. The present surveys, and Mr. Ali's reports on the collections made by him provide a considerable extension of our knowledge of the ornithology of this interesting area. The value of Mr. Ali's papers is enhanced by the ecological notes made by him while collecting in the field. The work reveals what can be done by a collector with an understanding of what work *in the field* implies. Systematics provide the basis of Biological Science but, if we are to advance beyond the foundations, there are other roads upon which this advance must be made, and one of them is the study of the living animal in relation to its environment. It is work, whose importance is being increasingly recognised and which offers abundant opportunity to students in this country. The thanks of the Society are due to Mr. Ali for the very thorough manner in which he has carried out these surveys and for the valuable contributions he has made to Indian Ornithology.

NORTH-WESTERN INDIA.

Sind and the Punjab.—Mr. K. R. Eates wrote on the distribution and breeding of the Koel (*Eudynamis scolopaceus*), the Greater Spotted Eagle (*Aquila clanga*), the Large Indian Paroquet (*Eupatria nepalensis*), the Northern Yellow-fronted Woodpecker (*Leiopicus mahrattensis blanfordi*) and the Rock-Horned Owl (*Bubo bubo bengalensis*) in Sind. The notes supplement the data provided in Ticehurst's work on the birds of the Province. The drying up in Sind, within the last fifty years, of many lakes and swamps has accounted for the disappearance or comparative scarcity of many species which were once abundant. The Samaro Dhand, once the breeding ground of hundreds of Cormorants, is now bone dry. Another species affected is the larger Spotted Eagle which, when Hume wrote about it 64 years ago, was the commonest species in Sind and which, as Mr. Eates shows, is now being replaced in the drier tracts by the Indian Tawny Eagle (*Aquila vindhiana*). On the other hand, the extension of cultivation and the planting of trees along natural and artificial waterways is attracting other species, among them the Koel which, unknown in the Province fifty years ago, first localised itself in Karachi and its environs, and which has now extended its permanent territory as far north as Nawabshah. The occurrence of this bird in towns and villages along the Pinyari Canal, which runs from Kotri to the southern boundary of the Province, suggests that its line of advance into Sind has been from Cutch and the Kathiawar States. The Large Indian Paroquet (*Eupatria nepalensis*) is another species which is extending its range in the Province. The great perennial canals now made possible by the Sukkur Barrage and the impetus given to cultivation and the planting of trees is radically affecting the fauna and flora of the Province whose physical features are undergoing so great a transformation under the agency of Man. Fortunately, ornithologists of the future in computing the nature, and extent of these changes, will have as the basis for comparative study Dr. Ticehurst's work on the birds of the Province. The value of such work to future students is emphasised in the paper on the *Birds of Lyallpur*, contributed by Messrs. M. Afzal Husain and Hem Raj Bhalla of the Punjab Agricultural College, Lyallpur. The area about which they write is particularly interesting as within the last forty years it has been transformed by intensive irrigation from a barren wilderness with typical desert vegetation into one of the most highly cultivated parts of the Punjab, where a rotation of crops and an increase of fruit and ornamental trees now provide food and shelter for an abundant bird life. The authors remark they had unfortunately no data as a basis for comparative study and were unable to indicate the extent to which the environmental changes had effected the bird life of the area. Besides providing a list of the birds of Lyallpur the authors deal especially with the food of the birds listed by them. This is a question of importance to agriculturists in India where so little is known about the significance of various species of birds in the control of insect pests of crops. Such scanty notes as existed were published by Mr. Mason in his paper on the Food of Birds in India (*Agri. Dept. Memoirs Entom. Series*, Vol. III). Mr. D'Abreu has carried out parallel investigations in the Central Provinces, and the present paper on the Birds of Lyallpur is a useful addition to the literature on the subject. Three years ago the Society made a representation to the Imperial Council of Agricultural Research in support of Mr. Salim Ali's proposal to carry out a systematic investigation into the food of birds in this country. The proposal received the support of the Bombay Provincial Committee, but a final decision on this question has been relegated to the nebulous future. We take this opportunity for stressing once again the need for the survey which cannot but be beneficial to the progress of agriculture in this country, and would draw a parallel to the intensive investigation into the food of birds carried out by the Board of Agriculture in the United States where the value of such research is appreciated.

The Revd. E. A. Storrs Fox's paper on the Birds of Murree is based on observations made in the hill station between the years 1932 and 1935. As the author's notes cover the cold weather, the paper forms a useful supplement to the previous articles on the birds of this area by Rattray (1903-4, vol. xvi, pp. 421, 675) and Magrath (1908, vol. xix, p. 142).

Mr. H. W. Waite reported the occurrence of some rare and hitherto unrecorded species in the Punjab; additions to the Punjab list are the Bronze-winged Jacana (*Metopodius indicus*), the Broad-billed Roller (*Eurystomus orientalis*), and Hodgson's Golden-backed Woodpecker (*Chrysocolaptes guttacristatus sultaneus*).

PENINSULAR INDIA.

Bombay and Salsette.—Parts II and III of the serial on the birds of Bombay and Salsette were published. The authors, Messrs. Salim Ali and Humayun Abdulali, aim at providing a handbook of the birds of these islands based on all the available records. Their notes on field identification, breeding habits, etc. enhance the interest and value of the work which, when completed, will be issued with the series of pamphlets on the Fauna of the Islands of Bombay and Salsette published by the Prince of Wales' Museum.

Southern India.—Mr. Edward G. Nichols contributed a paper on the Birds of Kodaikanal, a popular hill station in the Palni Hills, Madura District. The paper is confined to the birds observed in the station between April and June, and is intended especially as a guide to visitors who come there for the hot weather. Notes on field identification, haunts and song are included as a help to the recognition of the various species, 90 of which are listed in the work.

Mr. J. Williams wrote on the Game Birds of Anaimalai Hills and the South Coimbatore District. His paper deals with the game and semi-sporting birds occurring in the Valparai Planting District, the *sholah* country above it, and also in the low country around the foot hills of the Anaimalais. Deforestation in the developed areas has led to a distinct increase in the number of Fantail Snipe.

Mr. F. N. Betts contributed a well illustrated paper on the Birds of a South Indian Tank in the Province of Coorg. Ecological notes of this description covering bird life in relation to a particular environment deserve encouragement and indicate a line of study which might with advantage be followed by others in the country.

Mr. C. H. Biddulph supplements the information provided by the Vernay Scientific Survey of the Eastern Ghats in relation to the distribution and breeding of the White-bellied Sea-Eagle (*Haliaëtus leucogaster*) and the Short-toed Eagle (*Circaëtus ferox*).

Major Phythian-Adams records the occurrence of the Bittern in South Mysore marking an extension of its southernly range.

BURMA.

Mr. P. F. Garthwaite, assisted by Dr. C. B. Ticehurst, contributed observations on birds collected by him in the plains and foot hills of Burma. His notes supplement or correct the information provided in the new edition of the *Fauna* regarding the status and distribution of the species listed by him.

Mr. J. K. Stanford contributed notes on some rare birds of Northern Burma. Among the species mentioned are the White-collared Ouzel (*Turdus merula albocincta*), the Hen Harrier (*Circus cyaneus*) and the Scaup (*Nyroca marila marila*) which have not been recorded previously from Burma.

Birds and Ants.—In Vol. xxxviii, No. 3 of the Society's *Journal* Mr. Salim Ali referred to previous observations on the curious habit of birds introducing ants into their plumage. Many species indulge in this behaviour; some, like the crows and starlings, not only stick ants among their feathers but literally bathe in swarms of ants. In response to Mr. Ali's note further contributions were made to this interesting question by Capt. R. S. P. Bates, who describes how he saw a Song Thrush bathing in a swarm of red ants issuing from the ground; the crushed bodies of the ants could be seen adhering to the plumage. Mr. Bainbrigge Fletcher describes similar behaviour on the part of a Drongo which picked up ants with its beak and, before swallowing them, rubbed them on the root of its tail and also under its wings. The suggested explanation is that the birds employ the ants to rid themselves of parasites. Formic acid, which is well known for its antiseptic properties, emanating as it does from the crushed bodies of ants, might well have the effect of ridding the plumage of parasites. This is theory. How far the conclusion is correct further observation and experiment can alone decide. One interesting aspect of the question is that the habit is shown to be instinctive in as much as young birds taken from the nest, which could not have had a similar experience before, behaved exactly in the same way, though their plumage showed no trace of parasites.

Mr. Lowther's beautifully illustrated article on Nightjars deserves special mention. His camera studies of Indian Birds are delightful and their interest is enhanced by the well written narrative of his experiences with his subjects.

Reptiles.

Mr. A. G. L. Fraser completed his papers on the Snakes of Deolali. Part II dealt with the osteological characters of the snakes. Part III records the species obtained in the area. The author is to be congratulated on an extremely well written and interesting paper involving considerable original research in a fresh field of investigation.

The variation in the structure of the hemipenis in the Green Pit Viper, known as *Trimeresurus gramineus*, first indicated by Mr. and Mrs. Pope led them to recognise four distinct species: *gramineus*, *albolabris*, *stejnegeri* and *occidentalis*. *Gramineus* was restricted by them to the Indo-Chinese region, the westernly limit of its range being Darjeeling and the hill ranges of Assam; while the species occurring in the Indian Peninsula was given the name *occidentalis*. Dr. Malcolm Smith however indicates that the type locality of *gramineus* is Vizagapatam, and as such this name is more applicable to the Indian form. For the Indo-Chinese species, Dr. Malcolm Smith provides a new name *Trimeresurus popeiorum*. In the same paper, Dr. Smith gives reasons for applying Zaumenti's name *nepa* to the viper hitherto known as *Ancistrodon hypnale*.

A new species of Agamid Lizard (*Japalura kaulbacki*) is described by the author. The type is based on an immature male obtained by Mr. R. Kaulback in the Nyum Tamai Valley and Burma-Tibet Border.

Mr. C. McCann contributed an interesting article on the Common Agamid Lizard (*Calotes versicolor*) usually known as the Bloodsucker, in which he gives a detailed account of the breeding habits of the species.

Fishes

During the year we commenced publication of a serial, illustrated in colour and black and white on the *Game Fishes of India* by Dr. S. L. Hora. It is being written more or less in the lines of Stuart Baker's popular paper on Game Birds. Three parts were issued. They deal with the Indian Trout [*Barilius* (*Opsarius*) *bola*], the Bachhwa (*Eutropiichthys vacha*), and the Garua (*Clupisoma garua*). Since Thomas wrote his classic 'The Rod in India' progress has been made in our knowledge of Indian Fishes, but unfortunately, as the author points out, the scientific nomenclature of the various forms is in great confusion and it is difficult without much research to fix the precise generic and specific limits of even such common species as the Mahseer, generally known under the name of *Barbus tor*. While Dr. Hora's researches add considerably to the scientific value of these articles, his paper also includes such data as were available regarding the habitats and habits of the fishes described. These notes will be of particular interest to anglers and an appeal is here made to all those interested in the subject to send notes on fish and fishing to the *Journal* of the Society.

Fishes of Deolali—Apart from his interest in Snakes, Mr. Fraser during his stay in Deolali carried out a systematic survey of the Fresh Water Fishes of the area. Between June 1935 and May 1936, he collected some 4,463 specimens from different localities in and around Deolali and supplemented his collection with profuse ecological notes on fish life in various types of habitat. These collections form the basis of four papers by Dr. Hora. Part I gives the list of species with the description of the localities in which they were obtained. Part II, written by Fraser, contains his notes on the ecology of the fishes of the area. Parts III and IV, which will be published in 1938, will contain descriptions of new species and will discuss the geographical relationships of the fish fauna of Deolali with special reference to its affinities with that of the Deccan. The thanks of the Society are due to Mr. Fraser for the excellent manner in which he has carried out his survey, and to Dr. Hora and Mr. K. S. Misra for their work on these collections which will form an important contribution to Indian Ichthyology.

INVERTEBRATES.

Two articles of particular economic interest issued during the year are Mr. N. K. Panikar's article on the Prawn Industry of Travancore and Cochin, and Mr. C. McCann's paper on the Land Crabs of Bombay and Salsette. Mr. N. K. Panikar draws attention to the great possibilities of development of the Prawn fisheries in the backwaters of Travancore. He describes the history of the industry and the methods under which prawns are captured and marketed. He indicates that the marked deterioration in the industry is due in a large measure to various remediable handicaps. There is the lack of any scheme of planned production, secondly imperfect methods of preparation of the product, which limit the area of consumption and prevent successful competition, and finally the absence of any organization for marketing the produce. The author indicates methods by which the yield may be increased, and stresses the need for an investigation into the feeding, breeding and migratory habits of the prawns, and proposes improvements in methods of preservation and marketing.

Mr. McCann describes the life history and habits of the Land Crab (*Paratelphusa guerini*). Land Crabs, the genus *Paratelphusa* in particular, are generally considered as serious pests of paddy crops in certain districts. The author's conclusions regarding *P. guerini* in Salsette are that the damage done to rice crops is negligible. There is no general invasion of the fields by these crabs and such nipping of the leaf blades before transplanting as takes place is generally done by crabs living within the field. The damage is not severe. The author holds that the only real damage the crabs are responsible for is the riddling of the *bunds* between the fields with their burrows, thereby weakening them and causing their collapse. Damage to plant life is negligible.

INSECTS.

Afghanistan.—Collections made in North Afghanistan by N. N. Umnov in 1930 provide the basis of a paper on the *Blattodea*, *Mantodea*, *Phasmodea* and *Orthoptera* by Leo Misthenko. Such data as were available on the fauna of this little known area have been included in the paper. Several species are recorded for the first time and five new species of *Acridodea* are described.

Chinese Turkestan.—A paper on the Butterflies and Moths of Chinese Turkestan was contributed by Lt.-Col. J. W. Thomson-Glover. It is based on collections made in the Tekkes Valley, Tian Shan Mountains and the Bashi Valley, 80 miles south of Kashgar, and from Bostan Terek. The moths were mainly collected in the Residency gardens at Kashgar. The paper also includes a list of species collected on the journey from Srinagar to Kashgar and is supplemented with a list of the *Lepidoptera* collected by Stolickza within the Province in 1873 and 1874.

Aphids of the Deccan.—Mr. V. G. Deshpande of the Agricultural College, Poona, published a preliminary account of aphids collected by him in Poona during the last four years. Though these insects occupy a place among the major pests of agricultural crops in India, we have little knowledge about them and the only literature dealing with Indian species is the Aphididae of Lahore by Das (*Mem. Ind. Mus.*, Vol. vi, No. 4, 1918). A more complete knowledge of the life and habits of these insects is a necessity both from the economic and academic standpoints.

Interesting papers on the life history and habits of a Carton-Building Ant (*Crematogaster dohrni artifex*) and the Marriage Flight and Colony Founding habits of our Common Black Ant (*Camponotus compressus*) were contributed by P. N. Krishna Ayyar.

BOTANY.

In his paper on the Mosses collected in the Balipara Frontier tract in Assam by Dr. N. L. Bor, Mr. H. N. Dixon makes an important contribution to the bryology of the Province. The literature on the mosses of this area was limited so far to the work of Griffith and Mitten published in the *Musci Indiae Orientalis* and to the author's previous work on the mosses collected during the Abor Expedition (*Rec. Bot. Survey Ind.*, vi, pp. 57-73). The present paper is exceptionally welcome, dealing as it does with a particularly interesting area which has never been explored botanically. 40 species new to Science are described and 1 new genus.

Rev. Fr. Caius continues his series of articles on the Medicinal and Poisonous Plants of India. The orders dealt with are the

Spiderworts (*Commelinaceae*), the Campions and Pinks (*Caryophyllaceae*) and the Crowfoots (*Ranunculaceae*). The last family is one of the most important as there is scarcely a single plant throughout the order which can be regarded as harmless while some are deadly. Fortunately most crowfoots lose their acrid qualities when cooked or dried.

PUBLICATIONS.

Beautiful Indian Trees, by the late Rev. E. Blatter and Mr. W. S. Millard, which appeared originally as a serial in the Society's Journal, was published during the year. The book has been very favourably reviewed both in England and in this country. Its beautiful illustrations and the attractive manner in which the subject has been handled by the authors make it a work welcome to students and laymen. It maintains, as indicated by one of its reviewers, "the broad educative outlook which is known to be the policy of all the works of the Society."

THE MUSEUM.

The Natural History Section of the Prince of Wales' Museum where the Society's collections are now shown has been closed to the public since 1936 owing to the transfer of the collections to the New Wing. Work on installing the collections has been carried out since that time and three galleries—Mammals, Birds, Reptiles and Fishes are ready and will be opened by H. E. the Governor of Bombay on the 17th of March 1938. It is proposed to issue in the *Journal* a descriptive account of these galleries which are among the finest to be seen in any country; they indicate the advance which has been made in museum methods and technique during recent years.

REVENUE ACCOUNT.

This shows a deficit of Rs. 2,262-5-5 as compared with Rs. 835-10-5 last year.

Membership is down by 35 and the loss under this head is accounted by the fact that 44 members have not yet paid last year's subscription.

We have been fortunate in enrolling a new Vice-Patron—H. H. The Nawab of Junagadh, whose support is greatly appreciated, and we start 1938 well with a cheque for Rs. 5,000 from the Prince of Wales' Museum in repayment of work carried out and financed by the Society.

EXPENDITURE.

This shows a small increase of Rs. 132, compared with 1936.

Salaries and wages are up by Rs. 766, due to the restoration of the cut of 4 per cent, and it is satisfactory to note that other items of expenditure have been reduced.

MEMBERSHIP.

During the year 1937, 42 new members and 2 Life Members joined, 4 members died and 74 resigned.

The total number of Members on the Roll of the Society (excluding 186 Life Members) was as follows:—

31st December 1936	.. ...	964
,, ,, 1937	... ...	929

TAXIDERMY.

The Society's Taxidermy Department will close down at the end of April.

Mr. Johnson, our Taxidermist, has secured a promising appointment with the Singapore Museum, and will be leaving us when the work which he has in hand is finished. We wish him all success in his new appointment.

STAFF.

The Committee wish to record their appreciation of the good work done by the Curator and his staff during the past year.

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FORT, BOMBAY

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1937.

LIABILITIES		Rs A P	Rs A P
Life Membership fees :			50,725 0 0
Donations for specific objects unexpended :			
Show Cases, Models of Fish, etc. in Prince of Wales Museum—Account No. 1 ...		1,384 14 7	
Show Cases, etc. in New Building, in Prince of Wales Museum—Account No. 2.		2,095 9 11	
Special Journal Fund		8,773 2 4	
Ornithological Survey		1,619 9 3	13,873 4 1
Sundry Creditors :			
Brig. W. H. Evans, account Butterfly Books		118 6 10	
Messrs. John Bale Sons and Curnow, account Tree Book		2,042 15 1	
The Diocesan Press, Madras		1,941 13 2	
Messrs. Vandyke Printers		473 5 4	
For Expenses (Audit fee)		250 0 0	4,826 8 5
Surplus Assets :			
Balance as per last Balance Sheet ...		28 446 6 8	
	Rs A P		
Less.—Libel Case... ...	1,918 4 0		
Loss of Revenue Account.	2,262 5 5	4,180 9 5	24,265 13 3
Total ...			93,690 9 9

ASSETS	Rs A P	Rs A P
Investments—At holding value or Market value whichever is lower :—		
Rs. 35,000 3½% Loan 1947/50 at 102¼% ...	35,787 8 0	
,, 15,000 5% do. 1945-55 at par ...	15,000 0 0	
,, 10,000 3% do. 1951-54 at 98% ...	9,800 0 0	
,, 14,000 4% Bombay Port Trust Bonds at 77%	10,780 0 0	
,, 15,000 4 % Bombay Improvement Trust Bonds at 76%... ...	11,400 0 0	82,767 8 0
Rs. 89,000		
Cash—		
With National Bank of India, Ltd., Bombay	305 3 7	
With National Bank of India, Ltd., London, £160-4-0 at 1/6 ...	2,136 0 0	
Fixed Deposit with P. & O. Banking Corporation, Ltd., Bombay	5,000 0 0	
On hand	150 0 0	7,591 3 7
Sundry Debtors :		513 0 0
Taxidermy Department :		190 3 4
Advances to Staff :		315 0 0
Furniture :		
As per last Balance Sheet	1577 0 0	
Less Depreciation	25 0 0	1,552 0 0
Publications excluding Journals : Stock on hand as certified by the Hon. Secretary		300 0 0
Game Books, Vol. III : Stock on hand as certified by the Hon. Secretary		357 0 1
Beautiful Indian Trees : Stock on hand as certified by the Hon. Secretary		104 10 9
Total ...		93,690 9 9

Note.—A stock of 20,100 old Journals and the valuable research collection and Library of 2,600 volumes have not been taken into account on the asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.

In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

BOMBAY, *1st March, 1938.*

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

H. M. McGUSTY,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1937.

Dr.

	Rs A P	Rs A P
To Salaries	18,991 0 0	
,, Society's Contribution to Staff Provident Fund	1,440 13 0	
,, General Charges	635 9 4	
,, Rent	2 436 0 0	
,, Stationery and Printing	288 2 5	
,, Postage	713 14 6	
,, Library	230 1 2	
,, Audit Fee	250 0 0	
,, Fire Insurance	150 0 0	
,, Depreciation on Furniture	25 0 0	
,, Cost of printing Journals	6,037 15 4	
		31,198 7 9
Total ...		31,198 7 9

Cr.

	Rs A P	Rs A P
By Subscriptions	19,629 13 0	
,, Entrance Fees	450 0 0	
,, *Sales of :*		
Old Journals	854 0 4	
Game Books, Vols. I & II	540 5 2	
Society's Publications	455 9 3	
Bird Charts and Albums	421 6 7	
,, Interest on Investments and Fixed Deposit	3,159 0 5	
,,Profit on outside works .. .	925 15 7	
,, (Vice-Patronship Donation)	2,500 0 0	
		28,936 2 4
,, Expenditure over Income carried to Balance Sheet		2,262 5 5
Total ...		31,198 7 9

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1937.

	Rs A P	Rs A P
To Stock of Game Books, Vol. III	536 12 1	
,, Expenses during the year	3 4 0	
		540 0 1
,, Stock of Beautiful Indian Trees ...	1,550 7 7	
,, Expenses during the year	4,042 2 1	
		5,592 9 8

	Rs A P	Rs A P
By Sales of Game Book, Vol. III	183 0 0	
,, Stock on hand (31st December, 1937) ...	357 0 1	
		540 0 1
,, Sales of Beautiful Indian Trees ...	5,487 14 11	
,, Stock on hand (31st December, 1937) ...	104 10 9	
		5,592 9 8

Dr. **Cr.**

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1937.

	Rs A P	Rs A P		Rs A P	Rs A P
Fund No. 1					
To Expenditure on Fish Gallery, etc. ...	1,277 6 0		By Unexpended Balance as per last Balance Sheet	1,362 4 7	
,, Balance carried to Balance Sheet ...	1,384 14 7	2,662 4 7	,, Donations for the Modeller's Salary, etc.	1,300 0 0	2,662 4 7
Show Cases Fund No. 2					
,, Expenditure on Show Cases in New Building	1,725 8 0		,, Unexpended Balance for Show Cases in New Building as per last Balance Sheet		
,, Balance carried to Balance Sheet ...	2,095 9 11	3,821 1 11			3,821 1 11
Special Journal Fund					
,, Expenditure on Journals	2,666 6 2		,, Unexpended balance (Special Journal Fund) as per last Balance Sheet ...	11,089 8 6	
,, Balance carried to Balance Sheet ...	8,773 2 4	11,439 8 6	,, Donation received during the year ...	350 0 0	11,439 8 6
Ornithological Survey					
,, Expenses on Ornithological Survey ...	1,380 6 9				
,, Balance carried to Balance Sheet ...	1,619 9 3	3,000 0 0	,, Donation for Ornithological Survey ...		3,000 0 0

BOMBAY, *1st March 1938.*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.
Chartered Accountants, Auditors

(Sd.) H. M. McGUSTY,
Honorary Treasurer.

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